[MUSIC PLAYING]

ERIN FENDER: Hello, my name is Erin Fender. I am a cardiology Fellow at the Mayo Clinic. And I'd like to discuss with you what we know about long-term outcomes in patients with secondary tricuspid regurgitation.

I have no disclosures. We'll begin today talking about a case that highlights some of the dilemmas we face in clinical practice. This was an 85-year-old woman who presented with dyspnea and progressive abdominal distention. She had a history of chronic atrial fibrillation. And her weight had gone up 15 pounds over the preceding month.

She was admitted to hospital for heart failure. And this was actually her third admission in the last nine months. The echocardiogram demonstrated right ventricular and right atrial enlargement, with evidence of tricuspid annular dilation and leaflet malcoaptation. Color flow confirms severe tricuspid regurgitation with reversals into the hepatic veins.

So this case highlights some of the questions that we face in clinical practice. What is the patient's prognosis? How will her secondary tricuspid regurgitation impact her long-term survival?

Next, what is the best way to manage her? Should we continue medical therapy, despite the fact that she has been admitted three times in the last nine months? And then finally, if medical therapy is failing, when do we consider surgery?

That brings me to the objectives for today's talk. First, we'll define the epidemiology and incidence of tricuspid regurgitation. Next, we'll review what we know about long-term survival in these patients. We'll summarize the recommendations for surgery. And then finally, we'll discuss what we know about long-term operative outcomes.

We know from Framingham that tricuspid regurgitation is very common. In fact, 15% of men and 18% of women have mild or more tricuspid regurgitation. Moderate to severe or severe TR is present in 1.6 million Americans. And the vast majority of this is secondary or functional tricuspid regurgitation.

Now in contrast, we have primary TR. Primary TR is a issue with the valve leaflets themselves. You can see here that congenital heart disease represents one important cause. Many other causes are acquired conditions, such as rheumatic heart disease, endocarditis, carcinoid, or radiation.

An underappreciated cause however IS device leads. In a series of 41 patients who underwent surgery for tricuspid valve regurgitation, 41 cases were identified where patients TR was related to a pacemaker lead.

What's interesting is that, despite the fact that the surgeon confirmed involvement of the lead as the cause of the TR, in only five patients did the pre-operative echocardiogram identify that the pacemaker lead was responsible for the clinical syndrome. What this suggests is that in the majority of patients with pacemaker-induced tricuspid regurgitation, the echocardiogram is insensitive for the mechanism, whereby the lead causes the TR.

Turning our attention now to what's more common in clinical practice, which is secondary TR, this can be subdivided into two general categories. The first is pressure overload lesions, such as left ventricular systolic dysfunction, pulmonary hypertension, and mitral or aortic valve disease. Another category is right ventricular dilation, or isolated annular dilation, as occurs in dilated cardiomyopathy or atrial fibrillation.

Historically, there has been some debate about the extent to which atrial fibrillation causes tricuspid regurgitation. However, increasingly, data is shedding light on the mechanism whereby atrial fibrillation actually induces TR. A recent study using 3D transesophageal echocardiography looked at 432 patients with moderate to severe TR.

What they did is use the echocardiogram to define the mechanism of TR and identify that, in patients with no other explanation for the TR other than the AFIB, a unique mechanism emerged. In these patients, there was severe isolated annular enlargement. The right ventricle itself was normal. And the tricuspid valve tenting volume was also normal.

In patients in whom the tricuspid regurgitation was due to left-sided heart disease, there was only evidence of mild annular enlargement. There was, however, evidence of significant right ventricular dilation. And this resulted in an increased tricuspid valve tenting volume. What this study suggests is two completely separate pathologies resulting in tricuspid regurgitation, and supports a causal relationship between atrial fibrillation and the development of TR.

So why do we talk so much about the etiology of TR? And the reason is this has important prognostic and management implications. Patients with primary TR have abnormal leaflets, but the right ventricle itself is typically still normal. And therefore replacing or repairing the valve leaves the patient with normal myocardial function. And they will likely experience a positive post-operative result.

However, patients with secondary tricuspid regurgitation do not have a problem with the valve. They do, however, have a problem with the right ventricular or the annulus. And replacing the valve does nothing to address the underlying right ventricular myocardial dysfunction that's predisposed to the regurgitation in the first place.

That brings me to our second objective, which is to discuss long-term survival in patients with secondary tricuspid regurgitation. The sentinel study in this field was performed through the Veterans Administration, where 5,000 patients had echocardiograms reviewed. In 199 of these patients, severe tricuspid regurgitation was identified.

What the authors noted was that with increasingly severe tricuspid regurgitation, there was a corresponding decrease in long-term survival. And this persisted even after correcting for pulmonary hypertension and differences in left ventricular systolic function.

This study was then followed by a series performed here at the Mayo Clinic looking at patients with idiopathic severe TR. In this series, patients with left heart disease, pulmonary hypertension, and pacemakers were excluded. However, despite excluding patients with cardiac co-morbidities, they observed a significantly worse survival over a long-term follow-up.

In fact, patients who were symptomatic at enrollment experienced only a 36% long-term survival. What's more is that in asymptomatic patients, survival was much worse as well. By 10 years, only 46% of the cohort was still alive.

What this suggests is that patients who are asymptomatic still experience worse survival. And therefore, symptoms should not be considered the appropriate metric for determining the timing of referral to surgery.

That brings me to our third objective, which is to review our current society recommendations for tricuspid surgery. Current recommendations fall into two broad categories-- surgeries combined with left-sided valve operations, and those that are isolated tricuspid interventions.

In patients undergoing left-sided valve surgery, there are three recommendations. The first is for patients with severe tricuspid regurgitation. However, even patients with mild tricuspid regurgitation and evidence of annular dilation should be considered for an operation. Similarly, patients with moderate TR and evidence of pulmonary hypertension should undergo a combined repair of the left-sided valve and the tricuspid valve.

Turning now to isolated tricuspid surgery, the primary recommendations here relate to patients in whom the valve itself is abnormal. In patients with severe primary TR with symptoms that are refractory to medication, or in asymptomatic patients with primary TR but evidence of right ventricular maladaptation, surgery should be considered.

Now the only recommendation for patients with secondary TR relates to those with previous left-sided valvular surgery. In patients with severe secondary TR and previous left-sided valve surgery, an operation can be considered, so long as there is no evidence of right ventricular dysfunction or pulmonary hypertension. There are no recommendations in our current guidelines for de novo isolated surgery for secondary tricuspid regurgitation.

That brings me to our fourth objective, which is to discuss what we know about operative outcomes. Tricuspid surgery is a fairly rare event. Only 4,000 surgeries are performed nationwide each year. The vast majority of these are performed in combination with aortic or mitral valve surgeries.

So why is it that isolated surgery is so rare? And the primary reason is concerns over perioperative mortality. National claims data suggests that on average mortality for an isolated tricuspid surgery is around 8.8%. Now this is shockingly higher than what we see for aortic or mitral surgery.

So what accounts for this difference? And it's likely that the reason for such high operative mortality has to do with delayed referral to surgery. As a result of a delay in referral, patients may develop end organ dysfunction or chronic right ventricular dysfunction. And the right ventricular dysfunction may be under appreciated because it is masked by the tricuspid valve regurgitation.

In speaking with our surgeons here at the Mayo Clinic, they feel strongly that patients with significant tricuspid regurgitation should be referred much earlier to surgery. The surgery itself is often accomplished through a minimally invasive robotic approach, which does not require the patient to go on bypass.

Mortality is not occurring in the operating room, but rather in the immediate post-operative period when patients develop the sequela of end organ dysfunction and right ventricular dysfunction. And this in fact is what's driving up mortality. Were we to intervene sooner before patients were to develop these significant co-morbidities, it is likely that operative mortality, perioperative mortality, would be significantly improved.

Now while patients may have a high upfront cost to pay for undergoing a tricuspid surgery, what do we know about how they do in the long term? Does surgery actually improve survival and symptoms?

Looking first at symptoms in the post-operative state, this study examined outcomes in patients who underwent an isolated tricuspid surgery. Now in this series, about half of the population had isolated or functional tricuspid regurgitation. And the rest of the population had primary TR.

What they did note, that over follow-up almost 80% of patients experienced symptomatic improvement following their surgery, which supports that patients who undergo an operation feel better after their surgery.

But what about survival? Do we know how surgery impacts long-term outcomes? Many different studies have published long-term survival data after patients undergo tricuspid surgery. However, what our question really is is how do these patients do compared to those who were managed medically. There is only one small study that has actually addressed this specific issue.

In this study, 57 patients with severe tricuspid regurgitation underwent isolated surgery. 60% of this cohort had secondary TR. These patients were propensity matched against patients with severe TR who were managed medically.

And what they observed is that patients who were treated with surgery had a trend towards improved survival over long-term follow-up. However, this trend did not achieve statistical significance.

What this study suggests is that surgery may improve long-term outcomes. But given the small sample size, much further research is needed to help establish the role of surgery in managing patients with functional tricuspid regurgitation.

So in summary, we've shown that secondary tricuspid regurgitation does increase mortality. And that increased mortality is present despite the absence of significant cardiac co-morbidities or even symptoms.

Additionally, we've demonstrated that isolated tricuspid surgery is rarely performed. And the major reason for this is concern over in-patient operative mortality, which on average is around 8.8%. We do know that in patients who undergo surgery, their symptoms are improved. However, right now, there is no data that surgery improves long-term survival.

In conclusion, we know that secondary TR is a very morbid condition. We should really think about whether these patients would benefit from an operative approach earlier before the development of end stage and/or organ dysfunction, and right ventricular dysfunction. And see if operative mortality is improved with better patient selection.

Thank you very much.