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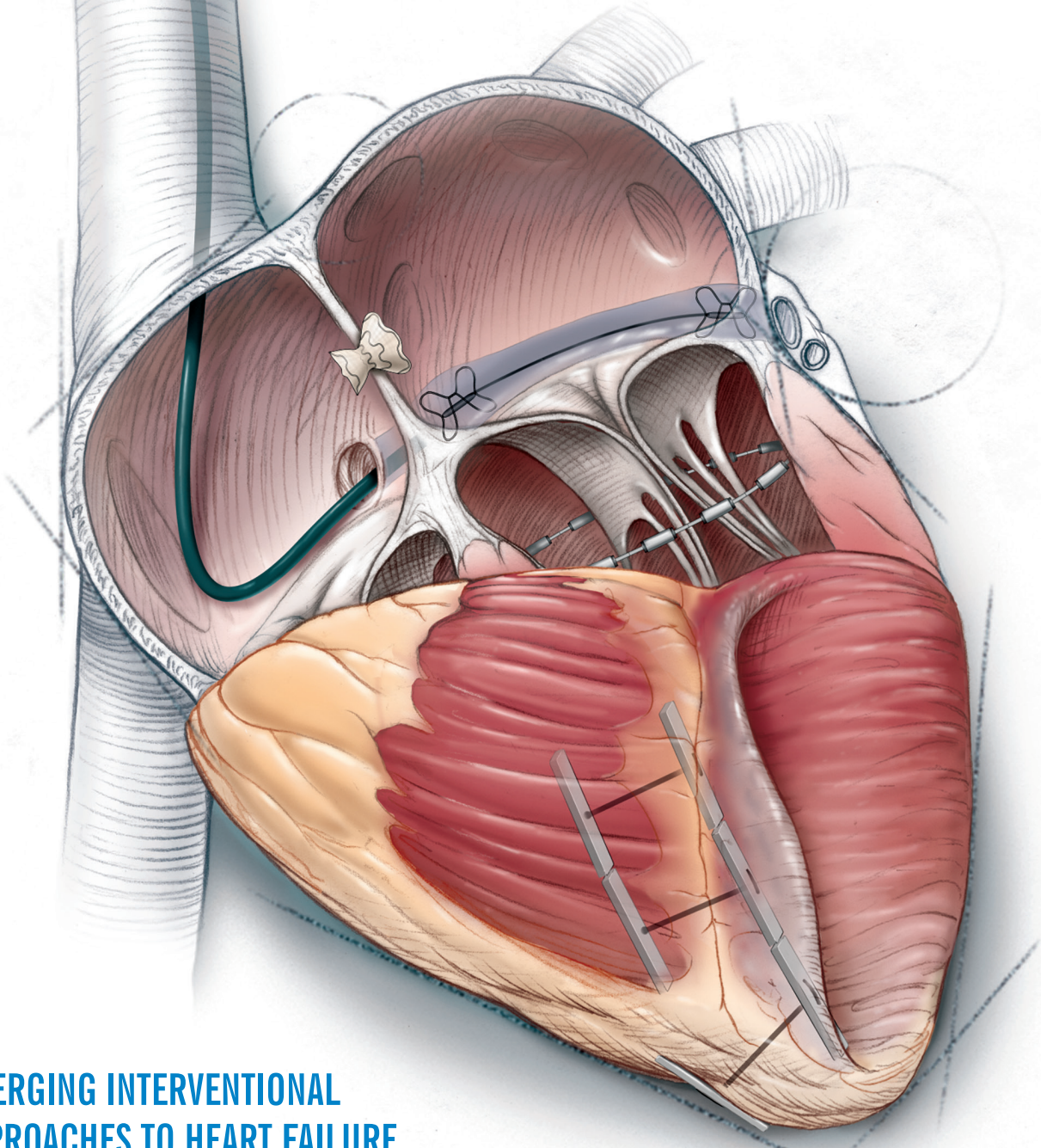


EMERGING INTERVENTIONAL APPROACHES TO HEART FAILURE

p. 4

DEAR COLLEAGUES,

A team of teams. At Cleveland Clinic, that is how we strive to function whenever possible. The idea is to facilitate collaboration at every level of our organization. The approach is particularly useful when broader cooperation is needed to address a difficult situation or to tackle especially challenging or multifaceted patient management problems when we need the best team to deliver care.

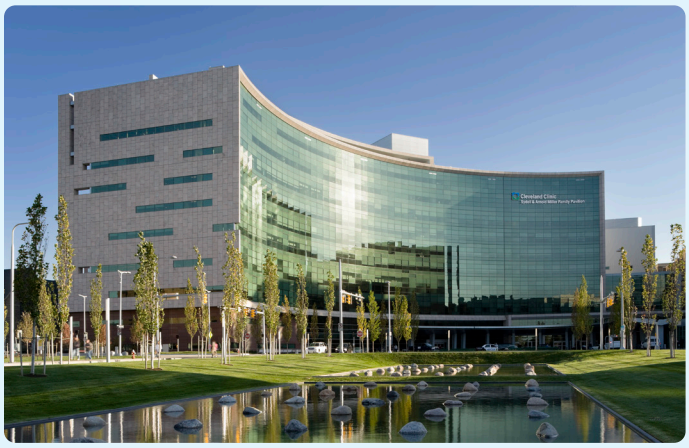
This team-of-teams ethic is on display in the work featured in this issue's cover story. The article profiles four investigational approaches to heart failure treatment in which our interventional cardiology team is partnering with our heart failure cardiology team and cardiac surgery team to offer percutaneous treatment options for patients who require more than guideline-directed medical therapy but are not ready for mechanical circulatory support or heart transplant.

The concept of a multidisciplinary heart team is not new to our Heart, Vascular & Thoracic Institute. It was already in use here for patients with complex coronary disease when we applied it during trials of transcatheter aortic valve replacement (TAVR). Its value for decision-making in the TAVR setting is illustrated in the story on page 14 that details insights from the Cleveland Clinic experience with alternative-access TAVR when transfemoral access is not feasible.

These are just a few examples of how taking a team-of-teams approach typically translates to doing the best by our patients. We welcome opportunities to team with you on particularly complex cases that may require referral. We will value you as a member of our team of teams with the goal of returning the patient to your care as soon as possible.

Respectfully,

Lars G. Svensson, MD, PhD
Chairman, Sydell and Arnold Miller Family Heart, Vascular & Thoracic Institute



Cleveland Clinic was named a top U.S. hospital in *U.S. News & World Report*'s "Best Hospitals" rankings for 2021-22, as well as the No. 1 hospital in cardiology and heart surgery for the 27th consecutive year.

BEST HOSPITALS
U.S.News & WORLD REPORT
CARDIOLOGY & HEART SURGERY
2021-22

RESEARCH ROUNDUP

LATE-BREAKING TRIALS FROM THE AMERICAN COLLEGE OF CARDIOLOGY 2022 SCIENTIFIC SESSION

VALOR-HCM: Mavacamten Reduces Need for Septal Reduction Therapy

Sixteen weeks of the investigational drug mavacamten significantly reduced the need for septal reduction therapy in patients with intractable symptoms of obstructive hypertrophic cardiomyopathy (oHCM) in the phase 3 VALOR-HCM trial. So reported Milind Desai, MD, MBA, Director of Cleveland Clinic's Hypertrophic Cardiomyopathy Center.

Traditional medical therapy (beta-blockers, calcium channel blockers and/or disopyramide) may improve symptoms of moderate left ventricular outflow tract (LVOT) obstruction, but it's typically inadequate when patients progress to severe symptomatic oHCM. In such cases, septal reduction therapy (SRT) — surgical myectomy or alcohol septal ablation — is highly effective, but also invasive.

Mavacamten is a targeted inhibitor of cardiac myosin designed to reduce the excessive contractility characteristic of HCM. The multicenter VALOR-HCM trial was conducted to assess its potential as an alternative to SRT in patients with refractory oHCM. The study's 112 enrollees had HCM with a maximum septal wall thickness ≥ 15 mm (≥ 13 mm with family history of HCM) and severe symptoms despite maximally tolerated medical therapy, and all were eligible for and actively considering SRT. Patients were randomized 1:1 to mavacamten 5 mg or placebo once daily by mouth. Echocardiography was performed every four weeks and used to titrate dosage based on LV ejection fraction and LVOT gradient.

The primary endpoint — a composite of the patient's decision to proceed with SRT by week 16 or continued eligibility for SRT (based on 2011 ACC/AHA guidelines) at week 16 — was reached by 77% of patients in the placebo group versus 18% of those in the mavacamten group ($P < 0.0001$). Mavacamten also showed significant benefits relative to placebo on all secondary endpoints: reduction in post-exercise LVOT gradient, improvement in New York Heart Association class, mean improvement in quality-of-life score, reduction in NT-proBNP and reduction in troponin I.

"Adding mavacamten to maximally tolerated medical therapy significantly reduced patients' eligibility for and/or desire to proceed with septal reduction therapy," says Dr. Desai. "If these effects safely endure over longer follow-up, mavacamten will fill an unmet need for a noninvasive treatment in this setting."

The study was funded by MyoKardia, which is developing mavacamten.

APOLLO: Novel siRNA Therapy Lowers Elevated Plasma Lp(a) in Phase 1 Trial

A single injection of a short interfering RNA (siRNA) that inhibits hepatic production of a structural component of lipoprotein(a) (Lp[a]) was well tolerated and associated with reductions of up to 98% of this hard-to-address cardiovascular risk factor. These findings, from the phase 1 APOLLO trial in 32 adults with elevated baseline Lp(a), were presented by Cleveland Clinic investigator Steven Nissen, MD, and published simultaneously in *JAMA*.

Elevated Lp(a) is an independent risk factor for atherosclerotic cardiovascular disease and aortic valve stenosis. Lp(a) levels are genetically determined and not significantly impacted by lifestyle modifications or currently FDA-approved medical therapies.

APOLLO tested an siRNA called SLN360, which binds and degrades the mRNA produced by the *LPA* gene that encodes for apolipoprotein(a), a key component of Lp(a), and reduces its production. The trial enrolled 32 adults with an Lp(a) level ≥ 150 nmol/L and no known cardiovascular disease. Participants were randomly assigned to one of four cohorts to receive a single subcutaneous injection of SLN360 (30, 100, 300 or 600 mg). Two participants in each cohort were randomized to saline placebo. All parties were blinded to randomization.

The primary efficacy measure was change in plasma Lp(a) from baseline to 150 days. SLN360 demonstrated a dose-response effect for plasma Lp(a) reduction, with a maximum reduction of 98% in the 600-mg dose group between 30 and 60 days after injection. Median reduction at 150 days was greater than 70% and 80% following the 300- and 600-mg doses, respectively. Apart from a transient threefold elevation of alanine aminotransferase and aspartate aminotransferase in one patient who received the 30-mg dose, no indicators of liver dysfunction or other serious adverse events were observed.

"siRNA therapeutics have the potential to offer very specific treatment with a long duration of effect," says Dr. Nissen. "This trial supports further development of SLN360 for patients with elevated Lp(a). Continued positive results could yield a useful treatment for this inherited condition that confers such high cardiovascular risk."

The study was funded by Silence Therapeutics, which is developing SLN360.

A NEW TAKE ON HEART FAILURE: EMERGING INTERVENTIONAL APPROACHES

Snapshots of four interventional therapies in clinical testing

For patients with heart failure (HF), the treatment landscape between guideline-directed medical therapy (GDMT) and left ventricular assist device (LVAD) implant or heart transplant is broad and challenging. Persistent symptoms despite GDMT substantially undermine quality of life and lead to frequent hospital admissions.

To make this landscape more navigable, clinician-researchers are increasingly exploring interventional approaches for the many patients whose HF is inadequately controlled by GDMT. While all of these approaches involve devices that are still investigational in the U.S., many show considerable potential for clinical use. Cleveland Clinic is leading or otherwise involved in clinical trials of at least four of these devices and approaches, which are profiled below.

EMPOWER trial in heart failure with functional MR

One interventional approach to HF involves placement of the Carillon Mitral Contour System®, which has CE mark approval in Europe for treatment of functional mitral regurgitation (MR). The Carillon device is placed in the right heart via transcatheter access through the jugular vein. After measurement of the coronary sinus to guide device size selection, the device is cinched and anchored in the coronary sinus to reshape the mitral valve annulus and reduce mitral annular dilation — and thereby theoretically improve heart function.

Although the device is not approved for functional MR in the U.S., its investigation for use in HF can be partly traced back to Cleveland Clinic's role as a core lab in early trials of Carillon for severe functional MR. "When our core lab experts read the echocardiograms, we saw that some patients did not have very much MR to begin with, and their ventricles were dilated," explains Samir Kapadia, MD, Chair of Cardiovascular Medicine at Cleveland Clinic. Post hoc analysis revealed that patients who received the device showed improvements in New York Heart Association (NYHA) class, Kansas City Cardiomyopathy Questionnaire (KCCQ) score, functional status and hemodynamics.

These secondary findings prompted Dr. Kapadia, an interventional cardiologist, and his Cleveland Clinic colleague Randall Starling, MD, MPH, of the Section of Heart Failure and Cardiac Transplant Medicine, to propose a multicenter study of the device in patients with any degree of functional MR — including mild and moderate — so long as they also had HF. "We felt it would be a reasonable strategy to try to treat the heart failure, not specifically the valve disease," Dr. Kapadia says. The resulting study is the EMPOWER trial (NCT03142152), for which Drs. Kapadia and Starling serve as national principal investigators (PIs).

The international trial, which launched last year, is expected to enroll 300 patients who have HF with at least mild functional MR — a population estimated to represent about 30% to 50% of all HF patients in the U.S. "This is an extremely large population that is not currently being addressed by studies of other novel therapies," Dr. Kapadia notes.

Patients will be randomized 1:1 in a double-blind manner to receive the Carillon device or a sham control device. The study has primary safety and efficacy endpoints at 12 months and will follow patients for five years.

"To be eligible for EMPOWER, a patient must be evaluated by a heart failure cardiologist who reviews the adequacy of their guideline-directed medical therapy," says Dr. Starling. "Our hope is that combining medications with the Carillon device will reshape the left ventricle so that it becomes smaller and there is less MR."

CORCINCH-HF in patients with reduced ejection fraction

The same general concept underlying the Carillon device — cinching the upper part of the heart to improve function — applies to another interventional HF treatment now in clinical testing, the AccuCinch® Ventricular Restoration System.

"AccuCinch is the first fully transcatheter therapy designed to restore, support and strengthen the dilated left ventricle in the setting of heart failure with reduced ejection fraction (HFrEF)," says Rishi Puri, MD, PhD, an interventional cardiologist who serves as Cleveland Clinic's site PI for a randomized controlled trial of AccuCinch known as CORCINCH-HF (NCT04331769).

The device is implanted transfemorally with a 20-Fr femoral arterial sheath. Placement involves retrograde aortic access with catheters specially designed to navigate around the chords at the base of the left ventricle. That provides a road map for positioning a guidewire to place and stitch in multiple anchors along the ventricle perimeter and then cinch, reducing the diameter at the base of the ventricle between the septum and the lateral wall.

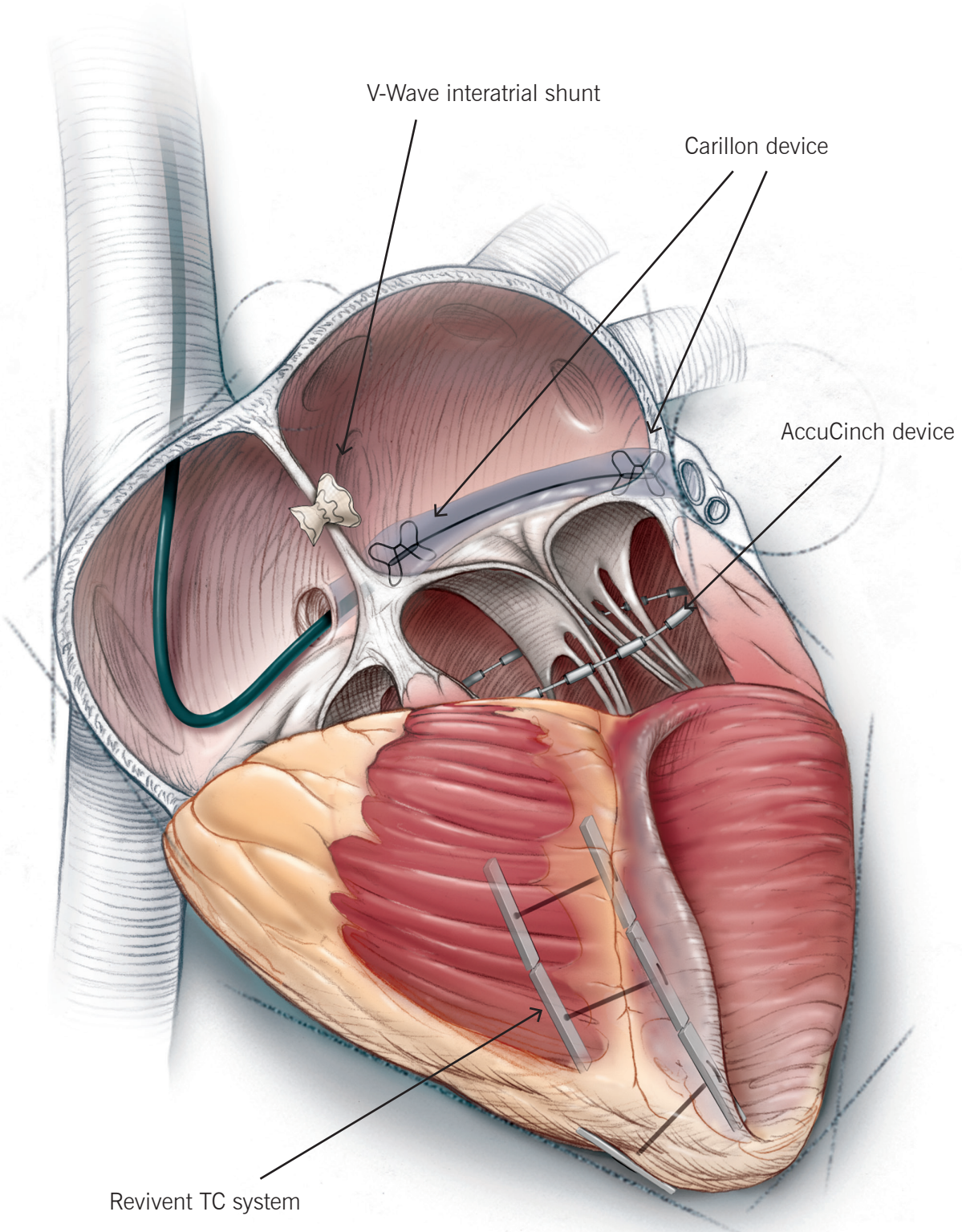


FIGURE — Illustration of the four featured interventional approaches. The **V-Wave shunt** diverts blood across the interatrial septum from left to right atrium to reduce filling pressure. The **Carillon device** is cinched and anchored in the coronary sinus to reshape the mitral valve annulus and reduce mitral annular dilation. The **AccuCinch device** reduces left ventricular wall stress and dimensions to improve myocardial contractility and overall function. The **Revivent TC system** is used to exclude the scar in ischemic cardiomyopathy with left ventricular scarring, thereby reducing left ventricular volume and wall stress.

THE STUDIES AT A GLANCE			
Trial	**Device and Procedure/Mechanism**	**Population**	**Design**
EMPOWER	Carillon Mitral Contour System; device is anchored and cinched in the right heart to reshape mitral valve annulus and reduce mitral annular dilation	300 patients with HF and at least mild functional mitral regurgitation	Randomized with sham control; double-masked
CORCINCH-HF	AccuCinch Ventricular Restoration System; device is anchored to the inner wall of the left ventricle and cinched to reduce ventricular wall stress and dimensions and improve myocardial contractility	400 patients with symptomatic HFrEF and LVEDD ≥ 55 mm despite GDMT	Randomized with GDMT alone as control; open-label
RELIEVE-HF	V-Wave Ventura Interatrial Shunt System; hourglass-shaped device is placed to shunt blood across the interatrial septum from left to right atrium to reduce excessive left-sided cardiac filling pressure	500 patients with NYHA II-IV HF despite GDMT, regardless of LVEF	Randomized with GDMT alone as control; double-masked
ALIVE	Revivent TC Transcatheter Ventricular Enhancement System; micro-anchors are placed by catheter in the right ventricle and via mini-thoracotomy in the outer wall of the left ventricle and drawn toward each other with a wire to reshape the left ventricular wall	126 patients with ischemic HF with left ventricular scarring	Nonrandomized assignment (2:1) with GDMT as control; open-label
HF = heart failure; HFrEF = heart failure with reduced ejection fraction; LVEDD = left ventricular end-diastolic diameter; GDMT = guideline-directed medical therapy; NYHA = New York Heart Association; LVEF = left ventricular ejection fraction			

"The aim is to reduce left ventricular wall stress and dimensions, initiating reverse remodeling to improve myocardial contractility and overall function," says Dr. Puri. "This should improve the patient's quality of life and survival, increase exercise capacity and reduce heart failure hospitalizations." He notes that implantation can take 90 minutes to three hours and involves a workflow similar to that of transcatheter mitral annuloplasty procedures.

The open-label CORCINCH-HF study is randomizing 400 patients at up to 80 centers to AccuCinch plus GDMT or GDMT alone. Patients must have symptomatic HFrEF (20% to 40%) despite GDMT, plus a left ventricular end-diastolic diameter ≥ 55 mm. The study has safety, clinical efficacy and quality-of-life endpoints at six and 12 months with follow-up for at least two years.

Like the Carillon device, AccuCinch was first designed to treat functional MR, and early feasibility studies in Europe suggested utility for HFrEF as well. Data from those studies showed 20-point improvements in quality of life as measured by KCCQ score. "Data with procedures such as MitraClip™ and transcatheter aortic valve replacement suggest that improvements of 10-plus points in KCCQ score tend to correlate with improved mortality and other outcomes," Dr. Puri notes. "That gives encouragement about the AccuCinch procedure's potential benefits."

RELIEVE-HF in advanced HF regardless of ejection fraction

Decompression of the heart is again the concept behind another interventional strategy — the V-Wave Ventura® Interatrial Shunt System. This approach involves implantation of an hourglass-shaped device designed to shunt blood across the interatrial septum from left atrium to right atrium. The aim is to reduce excessive left-sided cardiac filling pressure in the setting of advanced HF, thereby improving symptoms related to pulmonary congestion.

The shunt is placed by right-sided femoral catheterization. Its hourglass design holds it in place and makes blood transfer more efficient, enabling a smaller shunt size. "This is important because a previous interatrial shunt, which was larger, did not perform well in clinical trials, and this was believed to be due in part to its size," notes Dr. Kapadia.

The new shunt system is being assessed in the multicenter RELIEVE-HF study (NCT03499236), in which 500 patients are being randomized 1:1 to shunt placement plus GDMT or GDMT alone. To enable masking, all patients (including controls) undergo diagnostic right heart catheterization and invasive echocardiography, which is followed by shunt placement only in those randomized to the intervention arm. Eligible patients include those with NYHA class II, class III or ambulatory class IV HF despite maximally tolerated GDMT, regardless of left ventricular ejection fraction.

Primary endpoints are major device-related adverse events at 30 days and a composite of death, heart transplant/LVAD implantation, HF hospitalization, outpatient treatment of worsening HF, and change in KCCQ score at one and two years. Shunt recipients will be followed for five years.

In addition to participating in RELIEVE-HF, Dr. Kapadia and his interventional cardiology colleague Grant Reed, MD, MSc, are conducting a related investigation for which they obtained an investigational device exemption from the FDA. The open-label study (NCT04729933) is assessing the safety and feasibility of

implanting the interatrial shunt immediately after percutaneous mitral valve repair with the MitraClip device.

Patients are similar to those in RELIEVE-HF except that they also have at least moderate to severe functional MR. "Even with MitraClip treatment and maximum guideline-directed medical therapy, these patients are at high risk for recurrent heart failure events and admissions, so they represent an unmet need for further therapies," Dr. Reed explains. "Since we are already implanting MitraClip through the interatrial septum, the same transseptal puncture can be used to place the V-Wave device. This makes the interatrial shunt permanent and avoids an additional procedure."

The 10-patient study is being conducted solely at Cleveland Clinic. If results are promising, further study will follow. Meanwhile, primary completion of RELIEVE-HF is expected in late 2022.

ALIVE trial for ischemic HF with residual scar

A fourth interventional approach is being investigated for a more narrowly defined HF subpopulation. The Revivent TC™ Transcatheter Ventricular Enhancement System has been developed for patients referred for surgical treatment of ischemic cardiomyopathy with left ventricular scarring that is contiguous and includes both anterior and septal components.

Such patients may be considered for left ventricular reconstructive surgery with the Dor procedure, but this requires an open heart approach and cardiopulmonary bypass. "We are hopeful that Revivent TC will be shown to offer a better alternative for these patients whom we are hesitant to recommend for highly invasive surgery," says Edward Soltesz, MD, MPH, Surgical Director of Cleveland Clinic's Kaufman Center for Heart Failure Treatment and Recovery. "It's anticipated that this less-invasive approach will slow cardiomyopathy progression and improve quality of life."

The procedure involves hybrid placement of two sets of micro-anchors in the scarred heart. Internal micro-anchors are placed into the interventricular septum of the right ventricle by an interventional cardiologist using transcatheter access via the internal jugular vein. External micro-anchors are placed in the outer wall of the left ventricle below the scar tissue by a cardiac surgeon via a 4-cm mini-thoracotomy. When the micro-anchor pairs are drawn toward each other with a wire, the newly shaped left ventricular wall consists of functioning tissue and takes on a more normal shape and size.

In the wake of promising European data, the Revivent TC procedure is being studied in a U.S. trial known as ALIVE (NCT02931240), which is enrolling 126 patients assigned 2:1 to Revivent TC versus GDMT. Enrollment criteria are:

- Contiguous acontractile scar involving the septum and/or anterior, apical or anterolateral regions of the left ventricle
- Left ventricular ejection fraction ≤ 45%
- Left ventricular end-systolic volume index ≥ 50 mL/m^2
- NYHA functional class III to IV (ambulatory)

Primary safety endpoints include all-cause death, placement of a mechanical support device, and bleeding or tamponade at 30 days and one year. The primary effectiveness endpoint is a composite of freedom from readmission and improvements in quality-of-life score, six-minute walk distance and NYHA class. Patients will be followed for five years.

"The Revivent TC procedure offers a minimally invasive option to select patients with symptomatic ischemic heart failure without precluding advanced heart failure treatment options in the future," says the ALIVE trial's national co-PI, Jerry Estep, MD, Chair of Cardiovascular Medicine at Cleveland Clinic Florida. "If the trial results are positive, it will provide an appealing solution to the scar tissue that is the root cause of left ventricular dysfunction and disease progression in these patients."

How the emerging options stack up

Dr. Kapadia says several of these emerging interventional therapies for HF stand out in various ways:

- The Carillon device and the V-Wave shunt have the appeal of being relatively easy to implant and being applicable to large patient populations.
- While the AccuCinch and Revivent TC systems are tailored to smaller populations, each has potential to significantly impact the care of those specific patient groups.
- And while the Carillon device has accumulated a fair bit of clinical data from its availability in Europe, the first primary data from all the trials discussed are likely to come from the RELIEVE-HF trial of the V-Wave shunt.

From his cardiac surgery perspective, Dr. Soltesz adds: "Since all four approaches are performed minimally invasively, they do not obviate any advanced therapy options, such as heart transplant or LVAD implant, when these eventually become necessary."

For ultimate adoption, Dr. Kapadia notes, all of these new interventions for HF must be shown to get the risk-benefit calculation right. "The risk of new heart failure treatments must be low, because this is a patient population that can go downhill very fast," he says. "Safety is paramount in this realm."

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Contact Dr. Kapadia at 216.444.6735, Dr. Starling at 216.444.2268, Dr. Puri at 216.444.6731, Dr. Reed at 216.445.7396, Dr. Soltesz at 216.444.5680 and Dr. Estep at 877.463.2010.

GUIDANCE FOR SURVEILLANCE OF ISOLATED COMMON ILIAC ARTERY AND SMALL ABDOMINAL AORTIC ANEURYSMS

Most are slow growing and can safely be monitored every three years

Most small abdominal aortic aneurysms (AAAs) and isolated common iliac artery aneurysms (CIAAs) can safely be monitored every three years with duplex ultrasound, with larger ones needing more frequent surveillance. So conclude clinician-researchers from Cleveland Clinic in the wake of two studies they recently published on aneurysm surveillance and management — one on CIAAs in the *Journal of Vascular Surgery* and the other on small AAAs in the *Annals of Vascular Surgery*.

"The current recommendations from professional societies are based on a large amount of low-quality data and information from older databases," says vascular surgeon Jarrad Rowse, MD, lead author of the study on small AAAs and a co-author of the study on CIAAs. "We follow a large number of patients with these aneurysms, which gave us the opportunity to investigate this population further. These studies provide strong support for current society guidelines, with some refinements."

Isolated CIAA surveillance

Isolated CIAAs (Figure 1) — i.e., those not associated with a concomitant AAA — are rare, constituting only about 7% of all aortoiliac aneurysms. There is currently no well-defined surveillance regimen for monitoring them and no consensus on optimal size for performing elective repair. The European Society for Vascular Surgery recommends monitoring every three years for CIAAs 2.0 to 2.9 cm in diameter, and annually for larger ones.

"Current practice recommendations are extrapolated from the more ample abdominal aortic aneurysm data," says Sean Steenberge, MD, MSc, a surgeon in the Department of Vascular Surgery and first author of the study on CIAA surveillance. "We believe our study is the largest published single-center series specifically focused on isolated common iliac artery aneurysms."

Study design. The investigators reviewed duplex ultrasound and CT imaging of 244 isolated CIAAs (≥ 2.0 cm in diameter) among 167 patients (average age, 68.1 years; 94% male and 91% white) from 2008 to 2020.

Findings. More than two-thirds of the aneurysms were first identified with duplex ultrasound, with the rest by CT imaging. Aneurysm surveillance was performed by a combination of CT and ultrasound imaging in 57% of cases, and by serial ultrasound alone in 43%. Average length of follow-up was 62.1 ± 40.1 months, during which 19 patients (11%) underwent operative repair, with the average aneurysm diameter at the time of repair being 3.3 ± 1.02 cm. No aneurysms were symptomatic or ruptured at time of identification or during follow-up.

Two patients who had been lost to follow-up for several years after an initially discovered isolated CIAA were later found to have had unusually rapid aneurysm growth (0.5 to > 1 cm per year) in the subsequent years.

Recommendations. To detect a rare, rapidly growing isolated CIAA, the authors recommend conducting a follow-up imaging study one year after initial isolated CIAA identification for all patients. Thereafter, they endorse the following aneurysm monitoring regimen with duplex ultrasound or CT angiography (CT angiography is recommended to confirm ultrasound results when diameter reaches 3.0 cm), based on growth rates found in the study:

- Every three years for a maximum diameter of 2.0 to 2.49 cm (annual growth rate was found to be 0.02 cm)
- Every two years for a diameter of 2.5 to 2.99 cm (annual growth, 0.03 cm)
- Annually for a diameter ≥ 3.0 cm (annual growth, 0.13 cm for the entire cohort and 0.05 cm after omitting the two cases of extreme growth)

Full aortic surveillance is recommended every five years.

"We recommend elective repair when the diameter reaches 3.5 cm," says Dr. Steenberge. "But additional data are needed to strengthen that guidance."

Monitoring small AAAs

Current Society for Vascular Surgery guidelines support monitoring small AAAs (Figure 2) every three years if the diameter is 3.0 to 3.9 cm and annually if the diameter is 4.0

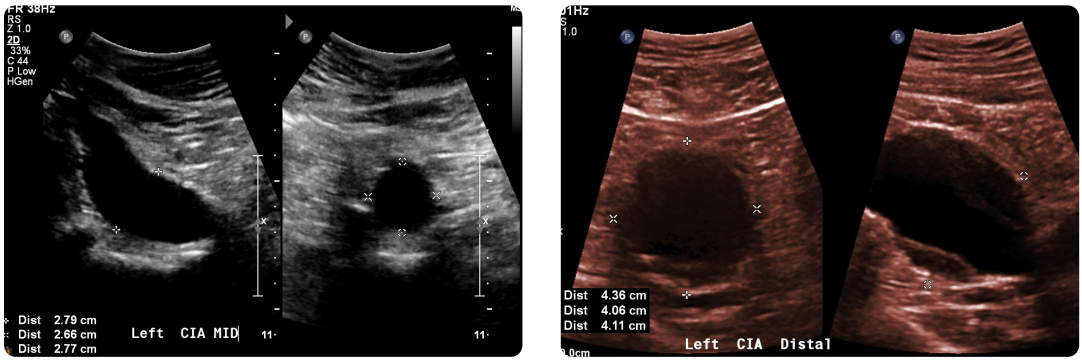

FIGURE 1 — Ultrasound images of isolated common iliac artery aneurysms with diameters of 2.7 cm (left panel) and 4 cm (right panel).

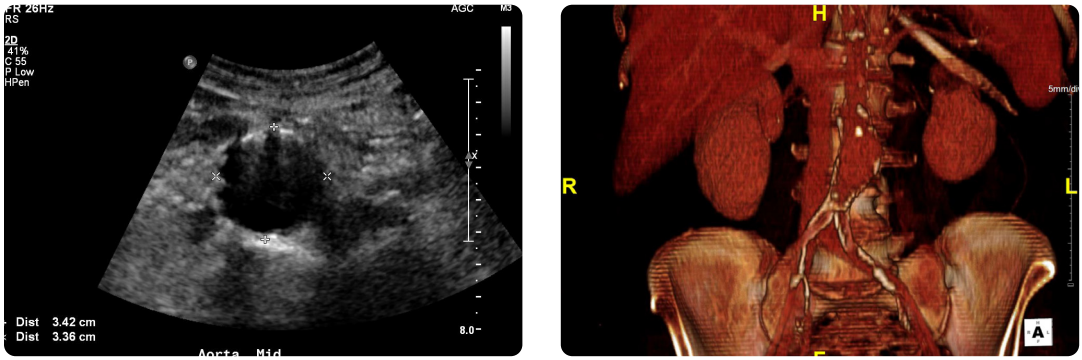

FIGURE 2 — Two imaging studies of small abdominal aortic aneurysms — an ultrasound on the left and a 3D CT reconstruction on the right.

to 4.9 cm, but these recommendations are based on low-quality evidence and provide no patient-specific guidance.

Study design. The population of the study on surveillance of small AAAs — patients with a baseline AAA diameter of less than 5.0 cm who had at least two ultrasounds — was identified from Cleveland Clinic records from 2008 to 2018. There were 1,581 patients (mean age, 73 years; 78% male and 93% white) and nearly 6,000 ultrasounds, with a mean follow-up of 28 months.

Findings. Average annual maximum diameter growth rates were found to be 0.18 cm for AAAs with a diameter of 3.0 to 3.9 cm and 0.36 cm for those with a diameter of 4.0 to 4.9 cm ($P < 0.001$ for the difference).

Growth rates varied considerably, with 68.2% of patients having no growth over the observed time period, 21.6% having expected growth and 10.2% having rapid growth.

Patient-specific factors. Patients who were male and had a baseline AAA size of 4.0 to 4.9 cm were more likely to have rapid growth ($P = 0.002$) and to undergo eventual repair ($P < 0.001$). Patients taking metformin were more likely to have no aneurysm growth ($P < 0.05$).

Recommendations. The authors write that their findings support the following surveillance schedule:

- For diameters 3.0 to 3.9 cm, every three years
- For diameters 4.0 to 4.9 cm, annually for men
- For women approaching the 5.0 cm threshold for intervention (threshold is 5.5 cm for men), closer surveillance is recommended

"Unlike in other studies, we did not find that small aneurysms grew faster in women," Dr. Rowse notes. "However, the cohort was too small to make definitive recommendations for women, so more study is needed to clarify their optimal surveillance strategy."

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Contact Dr. Rowse at 216.445.1167 and Dr. Steenberge at 216.445.9388.

LARGE COHORT STUDY OF ISOLATED TRICUSPID REGURGITATION YIELDS NOVEL RISK SCORE TO GUIDE CARE

Companion study shows apparent benefit from surgery in both primary and secondary TR

While understanding of aortic and mitral valve pathologies has progressed rapidly, the management of patients with isolated tricuspid regurgitation (TR) remains challenging. Although the condition is increasingly common, indications for intervention have not been well established, and operative mortality can be high.

Now a new Cleveland Clinic study in *JACC Cardiovascular Imaging* is helping to close the knowledge gap by shedding light on the etiologies and natural history of isolated TR in a large cohort. The researchers have also used the new information to create a risk model for predicting mortality outcomes in these patients.

"We hope this study and risk model will help guide cardiologists and cardiac surgeons on how to most effectively manage such patients," says corresponding author Milind Desai, MD, MBA, Director of Clinical Operations in Cleveland Clinic's Heart, Vascular & Thoracic Institute.

Mining data insights

The observational study — the largest of its kind yet published — included consecutive patients with isolated TR entered in Cleveland Clinic's adult echocardiography database between January 2004 and December 2018. All had isolated TR graded severe or moderate to severe by transthoracic echocardiography.

Of the 9,045 isolated TR cases identified, 94.8% were found to be secondary (pathology distorting the ventricular and/or atrial anatomy so as to impair valvular coaptation) and 5.2% were primary (pathology affecting the structural integrity of the valve). Both forms conferred adverse prognosis compared with the age- and sex-matched general U.S. population; secondary TR was associated with worse survival than primary TR in unadjusted but not in adjusted multivariable analysis.

The most common etiologies of secondary TR were left heart disease (54.4%), atrial functional disease (24.3%) and pulmonary disease (17.0%). Among cases of secondary TR, those associated with pulmonary disease had the worst survival, and those related to left heart disease had significantly worse survival than those related to atrial functional disease.

The most common cause of primary TR was infective endocarditis (47.2%), followed by degenerative disease/prolapse (18.3%) and prosthetic valve failure (16.8%).

A novel system for gauging risk

With the information on underlying etiology and mortality risk in hand, the authors devised a risk model to predict one-year all-cause mortality for patients with isolated secondary TR (Figure). The clinical, laboratory and imaging parameters included in the model combine for a score from 0 to 16, with increasing risk of mortality associated with rising score.

"The score stratifies mortality risk to potentially guide the management strategy for these patients," says the study's first author, Tom Kai Ming Wang, MBChB, MD, a cardiologist in the Section of Cardiovascular Imaging. "The higher the score, the worse the prognosis and therefore the greater the need to consider surgical or transcatheter tricuspid procedures, which remain underutilized. Furthermore, optimal medical treatments tailored to underlying etiologies are important, and these etiologies include heart failure, coronary artery disease, atrial fibrillation, chronic lung disease and endocarditis."

The novel scoring system was internally validated and is now being disseminated throughout Cleveland Clinic for use in the management of patients with isolated TR. "It's too soon to tell whether it has affected clinical practice, but we sure hope it has," says Dr. Desai. "We plan to share it on our website so anyone who manages valve disease can use it."

Not the final word

Although the novel scoring system is expected to be a significant asset in the management of patients with isolated TR, it continues to undergo refinement.

"Further research is required to determine the exact threshold of risk score associated with significant risk that would benefit from intervention," says study co-author Brian Griffin, MD, Section Head of Cardiovascular Imaging. "More research may also reveal whether there are other covariates, such as frailty or quantitative TR parameters, that can be added to further improve the model's accuracy and be considered when managing individuals with TR."

Risk Model for 1-Year All-Cause Mortality in Isolated Secondary TR

Parameter	Score
Age	
65-74 years	1
75+ years	2
Myocardial infarction	1
Peripheral vascular disease	1
Chronic lung disease	1
Chronic kidney disease (creatinine >1.4 mg/dL)	1
Loop diuretic use	1
Anemia (hemoglobin <10 g/dL)	1
Thrombocytopenia (platelet <15 k/μL)	1
International normalized ratio >1.5	1
Albumin <3.0 g/dL	2
Right ventricle systolic function	
Mildly impaired	1
Moderately impaired	2
Severely impaired	3
Right ventricular systolic pressure >50 mm Hg	1
Total score	16

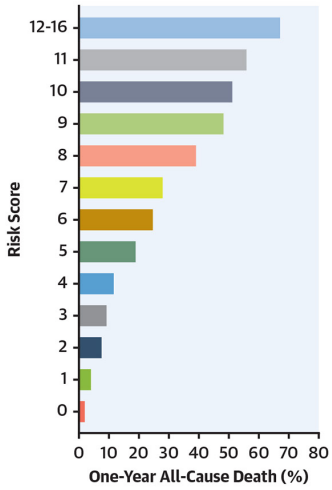

FIGURE — Parameters used in the risk score model (left) and estimated one-year mortality rate by risk score plot (right). Reprinted from Wang et al., *JACC: Cardiovascular Imaging*, copyright 2021, with permission from the American College of Cardiology Foundation.

Even after a patient's risk has been quantified, the optimal treatment strategy or combination of treatments remains unclear. "Randomized trials are urgently needed to compare the outcomes of surgical, transcatheter and medical therapies in patients with isolated TR," says Dr. Desai.

Companion study in the same cohort

Those randomized investigations may be shaped by the findings of an observational study published by the same group of Cleveland Clinic researchers in the *American Journal of Cardiology* (2022;162:163-169). Using the same large cohort of Cleveland Clinic patients with isolated TR from 2004 through 2018, this study analyzed outcomes according to management strategy.

Results showed that surgery was traditionally underutilized — performed in only 7% of patients overall — but steadily increased in use over the study period. Surgery was associated with improved survival compared with medical management alone, including after multivariable adjustment.

"Surgery showed a survival benefit in both primary and secondary TR," Dr. Wang observes. "That is notable because the benefit of surgery in TR, especially secondary TR, has been considered controversial."

For now, early referral is key

Until more information is gathered, the authors conclude, patients with TR are best managed in expert valve centers to achieve the best possible outcome in view of their high risk.

"It is important to identify patients early in their disease course, particularly before they develop heart failure, to enable referral to experienced heart teams for management," Dr. Wang notes. "As we demonstrated in another recent study (*Circ Cardiovasc Imaging*. 2021;14[9]:e012211), quantifying TR and right heart size and function through multimodality imaging evaluation with echocardiography and MRI parameters can be key to guiding decision-making for tricuspid procedures."

An additional perspective

"This new study provides an important warning that the prognosis of patients with severe TR is abysmal and that TR should not be ignored," says Amar Krishnaswamy, MD, Section Head of Invasive and Interventional Cardiology, who was not involved in the study.

"European trials and registries have demonstrated that percutaneous TR therapies are safe and effective in improving quality of life and survival," Dr. Krishnaswamy adds. "We are fortunate that a number of minimally invasive, catheter-based options to repair or replace the tricuspid valve are available at Cleveland Clinic. Unfortunately, patients with isolated TR require treatment as part of a randomized clinical trial since the FDA has yet to approve any percutaneous TR therapies. We hope that increasing data from analyses such as this one will help persuade the FDA to approve these treatments sooner rather than later."

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INOCA: A COMMON, DANGEROUS, OFTEN OVERLOOKED CAUSE OF CHEST PAIN

What to do when a patient's ischemia is not due to coronary artery stenosis

Ischemia with no obstructive coronary arteries (INOCA) is an increasingly recognized entity involving microvasculature dysfunction and/or vasospasm of the coronary arteries. Because the diagnosis requires specialized expertise and testing, it is frequently missed.

But leaving it undiagnosed puts the patient in peril, as INOCA is associated with repeated emergency department visits and hospital admissions and with increased incidence of cardiovascular events and death.

These characteristics have made INOCA an area of great interest for Cleveland Clinic interventional cardiologists Khaled Ziada, MD, and Claire Raphael, MD, PhD.

"Despite poor awareness of INOCA, we now know it is not rare, and that makes it an important topic," says Dr. Ziada. "Fortunately, we are gaining a better understanding of its mechanisms and how to diagnose and manage it."

Studies show that more than 50% of patients undergoing invasive angiography — particularly women — do not have obstructive coronary artery disease, with many of them having INOCA.

"I've seen many patients who are so grateful for a diagnosis of INOCA after having had their angina symptoms repeatedly dismissed by doctors," says Dr. Raphael. "Just knowing that their condition is a real entity is a tremendous relief and allows patients to move forward with management."

A different form of heart disease

Like angina caused by stenosis of the larger coronary arteries, INOCA involves a supply/demand mismatch of myocardial oxygen. Two major mechanisms — microvascular dysfunction and vasospastic disorders — have been identified, as detailed below.

Microvascular dysfunction involves small vessels that supply the myocardium but cannot be seen angiographically. The pathophysiology may be related to vasomotor dysregulation and structural remodeling of the arterioles.

So-called *microvascular angina* (MVA) is more common in women, especially during middle age. Risk factors are similar to those for atherosclerosis and include smoking, hypertension and dyslipidemia.

PET and MRI criteria have been established for the diagnosis of MVA, but they are not always reliable. Better diagnostic measurements can be performed in the catheterization laboratory (Figure): reduced coronary flow reserve and reduced blood flow velocities (using index of microvascular resistance testing) are indicative of MVA and predictive of elevated risk of cardiovascular events and death.

Vasospastic disorders involve spasm of coronary arteries. Hyperreactive smooth muscle cells and dysfunctional endothelium are likely underlying mechanisms. Vasospasm can be transient (causing Prinzmetal angina) or persistent, leading to myocardial infarction.

Vasospastic angina (VSA) more commonly occurs in Asians and men, with smoking being a major risk factor. It can be diagnosed in the catheterization lab, with provocative testing using intracoronary acetylcholine (Figure) and/or IV ergonovine.

These two INOCA endotypes — MVA and VSA — may overlap, which is associated with a worse prognosis.

"The key is to think about INOCA when we see patients who present with angina but have little or no evidence of plaque in their coronary arteries," says Dr. Ziada. "Appropriate testing can be done at the same time that we perform angiography."

Management on multiple fronts

Patients with INOCA need therapy to alleviate their angina symptoms and to address long-term risk of cardiac events. Neither MVA nor VSA can be treated with stents or bypass. Dr. Ziada offers the following guidance on various aspects of management:

- *Pharmacotherapy* may be helpful, although traditional anti-anginal medications tend to be less effective in INOCA. Options recommended for MVA are beta-blockers, calcium channel blockers, ranolazine and ivabradine. Options recommended for VSA are calcium channel blockers, long-acting nitrates and nicorandil. For all patients, statins,

aspirin, ACE inhibitors and angiotensin II receptor blockers should be considered.

- *Risk factor management* should include addressing hypertension, dyslipidemia and diabetes.
- *Lifestyle factors* involving nutrition, exercise, weight management, smoking cessation and stress reduction should be emphasized.

An active area of research

Meanwhile, research is underway on many aspects of INOCA diagnosis and treatment. The large WARRIOR trial (Women's Ischemia Trial to Reduce Events in Nonobstructive Coronary Artery Disease) is enrolling more than 4,000 patients at multiple sites to assess the impact of intensive medical treatment (high-dose statin, moderate-dose ACE inhibitor, angiotensin II receptor blocker) on mortality, myocardial infarction, stroke and hospitalization. Participants will be followed for three years, with results expected in 2024.

Cleveland Clinic staff are particularly excited about two promising avenues of innovative treatment:

- *Stem cell therapy for MVA*. Cleveland Clinic is involved in the ongoing multicenter FREEDOM trial, a double-blind, randomized, placebo-controlled study expected to enroll 105 patients. The therapy arm consists of a single infusion of autologous CD34+ cells into coronary arteries. Patients are monitored for up to six months for change in angina, exercise time and quality of life. The study is anticipated to be completed later this year. This method was tested in the IMPROvE-CED study on 20 patients with MVA. It was found to be safe, with encouraging outcomes.
- *Coronary sinus reducer.* Considerable research is focusing on the implantation of a coronary sinus reducer to treat refractory angina that is not amenable to stent placement. The hourglass-shaped device creates a focal narrowing, increasing pressure in the coronary sinus and thereby improving blood flow to the myocardium. Preliminary trials indicate that implantation is safe and leads to significant reduction of angina. Cleveland Clinic is exploring participation in a clinical trial of this device for refractory INOCA-related angina.

"Our understanding of INOCA is growing quickly, as is physician awareness," Dr. Raphael observes. "I am hopeful that it will soon be a well-recognized condition with effective therapy options."

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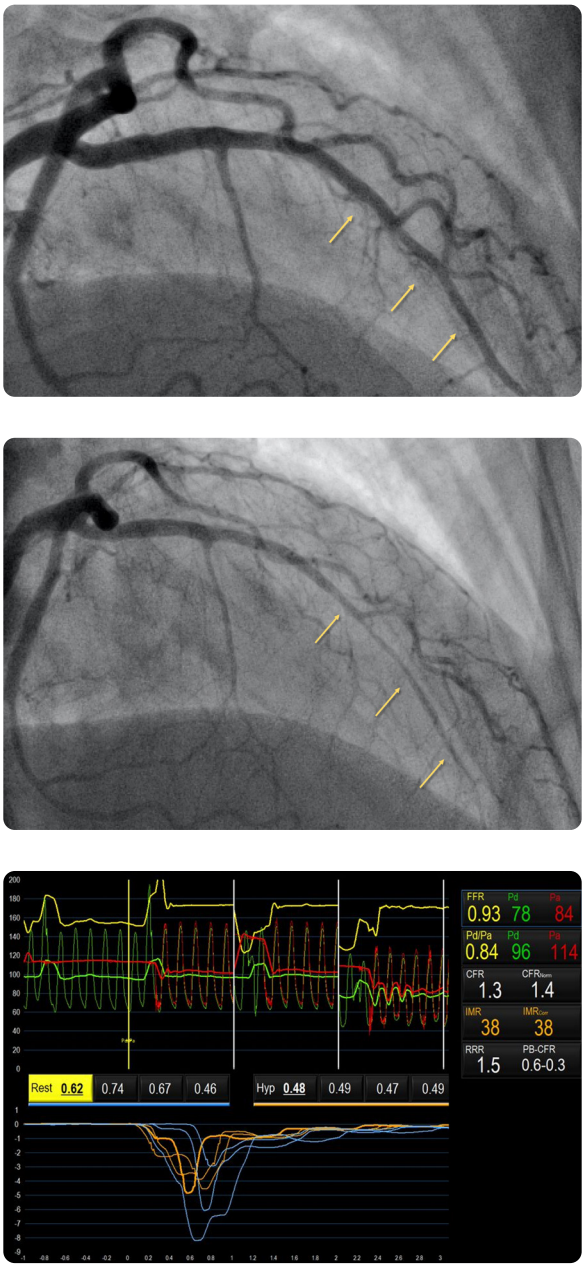
FIGURE — Acetylcholine provocation testing for coronary spasm and microvascular function testing. Top and middle panels demonstrate angiography of the left coronary system before and after intracoronary injection of acetylcholine 50 micrograms. Severe spasm is noted in the mid and distal left anterior descending artery (arrows) in response to the drug. When accompanied by ECG changes and reproduction of the patient's chest pain, this is diagnostic of vasospastic angina. The bottom panel demonstrates microvascular function testing in a different patient with INOCA. In this case, coronary flow reserve (CFR) calculated using the thermodilution method is abnormal at 1.3 (normal, > 2.0 or 2.5). The index of microcirculatory resistance (IMR) is also abnormal at 38 (normal, < 25).



WHAT'S THE BEST TAVR APPROACH WHEN TRANSFEMORAL ACCESS ISN'T FEASIBLE?

New study details trends in alternative-access TAVR from Cleveland Clinic

For patients who need transcatheter aortic valve replacement (TAVR) but whose anatomy precludes inserting the catheter through the femoral artery, the transaxillary approach has become the preferred alternative at Cleveland Clinic.

The health system's outcomes with transaxillary TAVR are comparable to those with transfemoral TAVR and superior to those with approaches that involve cutting into the chest, i.e., transapical and transaortic access. So finds a recent study published in *Annals of Thoracic Surgery* (2021;112:1877-1885) describing the evolution and outcomes of alternative-access TAVR at Cleveland Clinic.

Backdrop to the study

"In the modern era, about 5% to 10% of TAVR patients require access with a method other than the standard transfemoral route," says the study's corresponding author, James Yun, MD, PhD, of Cleveland Clinic's Department of Thoracic and Cardiovascular Surgery.

Typically the need for an alternative-access route stems from narrowness, tortuosity or excessive calcification of the femoral or iliac arteries or the aorta. For patients with such anatomy, alternatives include going through the apex of the left ventricle or through the aorta (both of which necessitate opening the chest cavity) or, increasingly, cutting down in the armpit to expose the axillary artery (i.e., the transaxillary approach).

While transapical access was the leading alternative to the transfemoral approach in the PARTNER clinical trials that helped establish TAVR, this approach was found to be associated with elevated rates of morbidity and mortality. This spurred interest in additional approaches, including transcarotid and transcaval routes in addition to the aforementioned transaortic and transaxillary approaches. The Cleveland Clinic researchers retrospectively reviewed their TAVR cases since introduction of the procedure to assess trends and compare outcomes and complications among approaches.

A favored alternative emerges over time

During the 13-year study period (January 2006 to January 2019), 2,446 TAVR procedures were performed at Cleveland Clinic, of which 2,032 (83%) were done using the transfemoral approach. The percentage of TAVR procedures performed using a femoral approach increased over time, while use of alternative approaches decreased.

Comparison of outcomes between the transfemoral approach and the collective alternative-access approaches showed similar rates of pacemaker requirements but showed the transfemoral approach to have lower rates of major vascular injury and higher rates of non-risk-adjusted five-year survival.

Among the alternative approaches, the vast majority of procedures involved transapical, transaortic or transaxillary access, with the favored alternative shifting from transapical to transaortic to transaxillary over time. Since 2016, transaxillary access has been the most common of all alternative approaches.

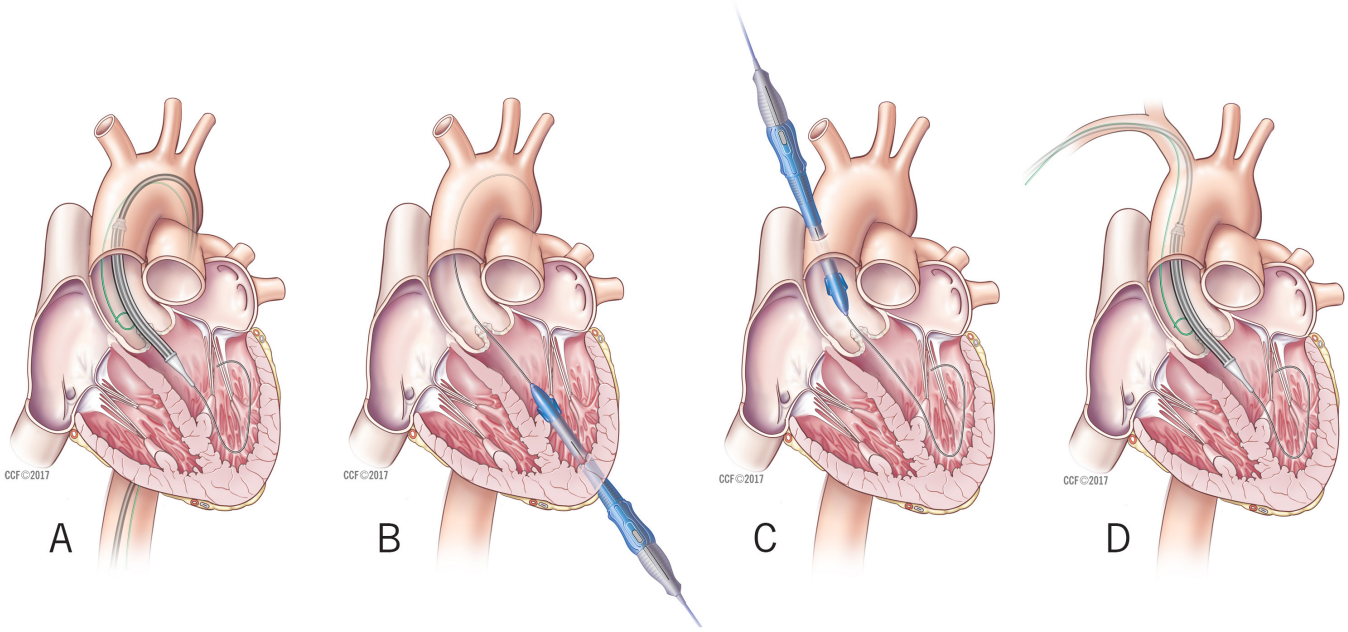
> "About 5% to 10% of TAVR patients require access with a method other than the standard transfemoral route. … The transaxillary approach involves the least morbidity of all the alternatives to transfemoral TAVR." — JAMES YUN, MD, PHD

Analysis showed that compared with the intrathoracic approaches (transapical and transaortic), the transaxillary approach was associated with significantly fewer blood transfusions, lower rates of prolonged ventilation, less postoperative atrial fibrillation, shorter length of stay, greater likelihood of being discharged home and statistically similar rates of stroke.

"The transaxillary approach involves the least morbidity of all the alternatives to transfemoral TAVR," says Dr. Yun.

Notably, propensity-matched comparisons of transfemoral versus transaxillary approaches since 2012 showed survival and major morbidity rates to be similar between the two methods. No brachial plexus injuries occurred in patients undergoing transaxillary TAVR.

FIGURE — Illustrations depicting transfemoral TAVR (A) and some leading alternative approaches: transapical (B), transaortic (C) and transaxillary (D).



Endless evolution

"TAVR is evolving," notes study co-author Samir Kapadia, MD, Chair of Cardiovascular Medicine at Cleveland Clinic. "Today's devices and technology are more refined than in the past. In the early years, transapical access was the most common alternative for patients not amenable to transfemoral access. But now, at our center, transaxillary TAVR has become our preferred alternative approach." He adds that the procedural shifts observed in this Cleveland Clinic study are consistent with national trends recently reported in the Transcatheter Valve Therapy registry.

"TAVR has grown in popularity year by year," adds Dr. Yun, noting that TAVR volumes at Cleveland Clinic reached a new high of 732 in 2019, the first full year after completion of the study period reported here. "It is less invasive and frequently safer for frail older patients than surgical aortic valve replacement [SAVR]." While SAVR remains more common than TAVR at Cleveland Clinic, its volumes have declined modestly from a peak in 2010 as TAVR indications and volumes have expanded.

Team-based tailoring of treatment

At Cleveland Clinic, decisions about a patient's suitability for TAVR versus SAVR, as well as which TAVR approach to use, begin with a discussion by a multidisciplinary heart team. If TAVR is deemed the best choice, transfemoral access is the default. However, if the patient has small femoral or iliac arteries, significant calcification of these arteries or of the aorta, or severe aortic tortuosity, then transaxillary access is the next best option.

But not all these patients can undergo transaxillary TAVR:

- Transaortic TAVR may be best for those with an ipsilateral in situ internal thoracic artery graft; axillary arteries that are small, calcified or severely tortuous; or an ipsilateral dialysis fistula.
- For those with calcification of the ascending aorta or other contraindications, transapical TAVR access may be indicated.
- For patients in whom transaxillary or transaortic TAVR is not feasible and who also have extensive myocardial thinning, poor left ventricular function or a displaced apex, TAVR access can also be achieved via a carotid artery, an iliac artery or the inferior vena cava — or perhaps SAVR may be the best option if the surgical risk is acceptable.

"Cleveland Clinic is one of the few centers that offer alternative-access approaches," notes interventional cardiologist Grant Reed, MD, MSc. "Our team-based approach allows us to guide every patient to the best treatment option, individualized for their specific situation. The close collaboration between cardiology and cardiothoracic surgery is one of the many reasons Cleveland Clinic's TAVR and SAVR outcomes are outstanding."

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CASE STUDY IN COLLABORATION

HOW MEDSTAR HEALTH HAS SUCCESSFULLY INTEGRATED CARDIOVASCULAR QUALITY PROCESSES ACROSS MULTIPLE SITES

Standardized practices from registries to quality meetings yield efficiencies and value

Standardization of quality across a hospital system is critical to building the foundation for integrated and efficient care delivery throughout the system. That is the experience of three hospitals in the MedStar Health organization — Washington Hospital Center, Union Memorial Hospital and Southern Maryland Hospital Center — that have worked together to integrate best practices around collecting, analyzing and applying their cardiovascular care data to promote continuous improvement in quality and patient outcomes.

MedStar Health is a recognized leader in heart and vascular care, with more than 200 specialists across 10 hospitals and physicians' offices throughout the greater Washington, D.C., area and central Maryland. MedStar's outstanding national and international reputation is complemented by its nine-year alliance relationship with Cleveland Clinic's Heart, Vascular & Thoracic Institute (HVTI). The alliance offers value through a variety of in-depth collaborative activities between the two health systems, including the sharing of best practices in various clinical and operational realms of cardiovascular care.

Sharing experiences around quality process integration

Since both organizations are multihospital systems that have added hospitals over time, sharing of best practices for cross-hospital standardization of quality data collection and utilization has been a particularly beneficial area of focus. This involves everything from ensuring a shared structured approach to data metrics to consistency in cardiovascular registry management, quality meetings and outcomes dashboards.

Cleveland Clinic's HVTI Advisory Services team has worked with their counterparts at the three MedStar hospitals participating in the alliance relationship — Washington Hospital Center, Union Memorial Hospital and Southern Maryland Hospital Center — to share insights from Cleveland Clinic's experience in systemwide integration of quality and registry practices. This work has contributed to enhanced standardization across the MedStar hospitals in a range of areas. A few examples are outlined below.

Cardiovascular registries

Although the three MedStar hospitals report cardiovascular registry data separately, they realized they could gain efficiencies through greater centralization of their registry efforts. In response, the HVTI Advisory Services team shared how Cleveland Clinic works as a system through its centralized cardiovascular registry department. That experience was helpful as the quality and registry teams of the MedStar hospitals worked to standardize registry interfaces and workflows and identify shared ways to optimize staff utilization, ensure timely abstraction and adjudication, and promote active communication of feedback.

The three hospitals' quality and registry teams continue to use their joint monthly calls with the Cleveland Clinic team to further exchange best practices and identify processes that can be replicated at all of their sites.

Systemwide outcomes dashboard

The MedStar teams recognized that standardization of registry practices calls for standardizing outcomes dashboards as well, to promote consistent reporting of collected data at all sites. Dashboard standardization also ensures that outcome metrics are presented in a comprehensive and timely way and can achieve maximum impact through effective visualization of data and trends.

The three hospitals' registry and quality teams collaborated to develop a systemwide outcomes dashboard. Cleveland Clinic shared its systemwide dashboard as a general model for reference, which the MedStar teams drew from as appropriate to meet their specific needs and preferences. This effort also extended to interfaces with the technology platform used to populate registry data into the dashboard; these interfaces were replicated across MedStar sites for efficiency and optimal performance.

Best practices in using quality metrics

Beyond integrating data technology, achieving a systems approach to quality monitoring and improvement requires

SYSTEMS APPROACH TO COMBINED CATH LAB QUALITY MEETINGS

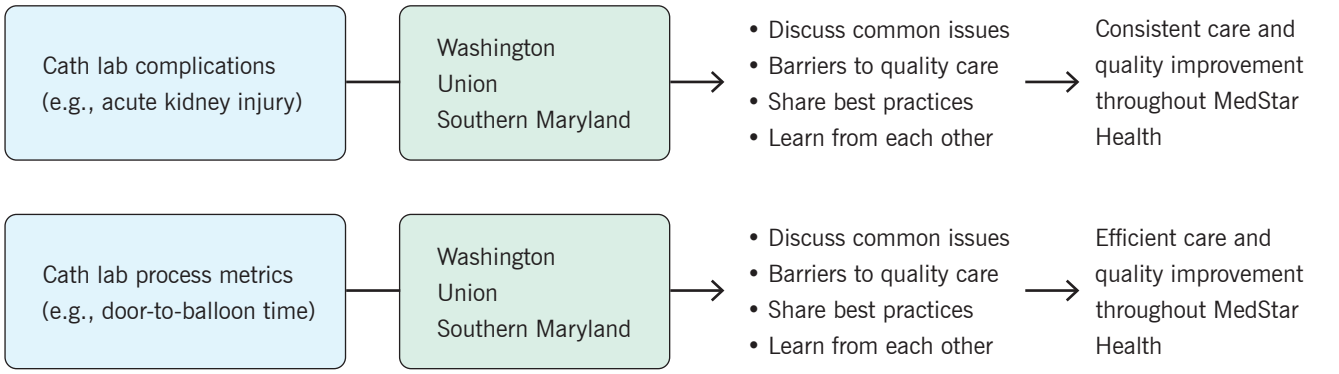

FIGURE — Schematic showing how combined quarterly quality meetings are run among the three MedStar Health hospitals' registry and quality teams, using catheterization lab quality as an example. Meetings are focused on metrics and centered on MedStar's outcomes as a system, with benchmarking among the three hospitals for jointly defined metrics. All sites discuss and share issues and best practices to promote consistent work plans and patient care throughout MedStar Health.

standardizing which metrics to focus on and how best to connect those metrics to positive patient outcomes. As the three MedStar teams worked to align which metrics to prioritize for maximum impact, Cleveland Clinic shared its standardized approach to quality metrics, along with policies and improvement plans it has used to improve key metrics in a consistent way across multiple sites. For example, MedStar and Cleveland Clinic have collaborated on optimizing door-to-balloon time for ST-elevation myocardial infarction (STEMI) cases by implementing an emergency room bypass policy and using a STEMI handoff tool.

Making the most of quality meetings

The alliance relationship provides another opportunity for the three MedStar hospitals to enhance their collaboration around registry and quality issues: combined quarterly quality meetings. At these regularly held video meetings, multidisciplinary teams from the MedStar hospitals and Cleveland Clinic's team jointly review all three hospitals' metrics (Figure).

Registry/quality personnel and clinicians — including physician leads — from all sites come together to discuss shared challenges, share best practices for solutions and benchmark their metrics against each other to improve performance across the system. These interactive quality meetings have become an ideal forum for helping translate the teams' enhanced data collection and analysis efforts into improved patient outcomes on priority metrics.

Learning from shared experiences

"Integration of registry and quality efforts across sites is a challenge that all multihospital systems have had to contend with, including Cleveland Clinic," says Edward Soltesz, MD, MPH, Cleveland Clinic's Director of Cardiac Surgery Affiliate and Alliance Programs. "We are pleased to be able to share our experiences in this realm with MedStar and to learn from them in turn. Coordination is not as easy to achieve as it may seem. What is certain is that the quality of patient care stands to benefit from it."

"The evolution of 'systemness' is a critical journey for hospitals and providers as more and more of us find ourselves linked through both internal mergers and external alliances and affiliations," adds Stuart F. Seides, MD, Physician Executive Director of MedStar Heart & Vascular Institute. "Nowhere is that more evident than in the realm of quality assurance, with real value generated through shared best practices, efficiencies and know-how."

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For more information on affiliations and alliances with Cleveland Clinic's HVTI, email Amanda Lesesky at leseska@ccf.org.

CME PREVIEW

GLOBAL EP SUMMIT TO PROVIDE AN ESSENTIAL ELECTROPHYSIOLOGY UPDATE THIS SEPTEMBER

Global EP Summit 2022

Hilton Cleveland Downtown, Cleveland, Ohio
Fri.-Sat., Sept. 23-24

Information/registration: ccfcme.org/globalep22

For the latest practice insights across the spectrum of electrophysiology (EP) care, there is no better forum this year than the Global EP Summit 2022. At the CME-certified symposium in downtown Cleveland, global leaders in EP research and clinical practice will share the most recent developments to help electrophysiologists and other cardiovascular clinicians keep their practice current and maximally beneficial to patients. The course is developed and directed by Cleveland Clinic with co-sponsorship by the Heart Rhythm Society.

"This year marks our fourth offering of this summit and the first in-person offering since the inaugural summit in 2019," says summit co-director Walid Saliba, MD, Director of Cleveland Clinic's Electrophysiology Lab. "We will explore current challenges and leading practices in the management of atrial fibrillation (AF), ventricular tachycardia (VT), ventricular fibrillation and other arrhythmia-based syndromes using a mix of sessions from past years and new sessions providing additional perspectives on practice and research."

Dozens of experts on tap

This year's summit features the largest faculty to date, with more than 40 experts from Cleveland Clinic, other leading U.S. institutions and top centers in Canada and Europe. Among them are numerous renowned EP practitioners as well as basic science researchers and specialists in cardiac surgery, heart failure cardiology and vascular neurology.

"We want to bring together EP experts not just to discuss the newest developments but also to drive innovation and collaboration in our field worldwide," notes summit co-director Oussama Wazni, MD, MBA, Section Head of Cardiac Electrophysiology and Pacing at Cleveland Clinic.

The summit will provide opportunities for interaction with faculty via Q&A segments and/or panel discussions at the end of each of its seven themed sessions, which consist of briskly paced 10-minute overviews of well-focused topics.

Content at a glance

Over a day and a half (Friday plus Saturday morning), sessions will address the following:

- *Hot topics in AF ablation,* including early ablation, the current status of pulsed-field ablation, ablation of persistent AF, AF ablation for heart failure with preserved ejection fraction, high-density mapping in various contexts and more
- *Stroke prevention in AF,* covering screening for stroke risk, the role of genetics, personalized stroke prevention and multiple aspects of left atrial appendage (LAA) closure
- *Recorded cases* of pulsed-field ablation and LAA occlusion procedures using various devices
- *Ventricular arrhythmia management,* including substrate mapping for VT, activation mapping for hemodynamically nontolerated VT, new targets for ablation, VT ablation in nonischemic cardiomyopathy and more, as well as a 30-minute roundtable on multidisciplinary collaboration for VT management
- *New advances in device management,* covering various issues in lead extraction, new device technologies, conduction system anatomy, physiologic pacing, and treating and preventing device infection
- *Innovations in EP,* from optical mapping of AF to the role of artificial intelligence/big data to new energy sources and more
- *Cleveland Clinic EP in action,* involving discussions of challenging cases across the spectrum of EP care

"The latter session, which concludes the summit, is new this year and will likely be a highlight," says summit co-director Shady Nakhla, MD, a staff electrophysiologist at Cleveland Clinic. "It also includes a discussion of how to strive to build the world's finest EP program. That's emblematic of what this course aims to do — help attendees leave with information and guidance on how to improve their EP program and EP practice right away."

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For more details, visit ccfcme.org/globalep22.
Early-bird pricing ends Aug. 1.

This activity has been approved for *AMA PRA Category 1 Credit™*.

CARDIAC CONSULT STAFF

Cardiac Consult is produced by Cleveland Clinic's Sydell and Arnold Miller Family Heart, Vascular & Thoracic Institute.

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SAVE THE DATES FOR CME

22nd Annual Intensive Review of Cardiology
Fri.-Sun., Aug. 19-21, 2022
Offered virtually by livestream
Information/registration: ccfcme.org/cardioreview22

The Practice of Echocardiography at Cleveland Clinic 2022
Sat., Sept. 17, 2022
Offered virtually by livestream (complimentary registration)
Information/registration: ccfcme.org/echocardio22

Global EP Summit 2022
Fri.-Sat., Sept. 23-24, 2022
Hilton Cleveland Downtown, Cleveland
Information/registration: ccfcme.org/globalep22
(see page 18 for a detailed preview)

Advancing Cardiovascular Care: Current and Evolving Management Strategies
Fri., Oct. 7, 2022
Columbus Marriott Northwest, Dublin, Ohio
Information/registration: ccfcme.org/columbuscvcare22

Cardiovascular Update for the Primary Care Provider
Thu.-Fri., Oct. 20-21, 2022
Marriott Cleveland Downtown at Key Center, Cleveland
Information/registration: ccfcme.org/cvupdate22

Mastering the Mitral Valve
Fri.-Sat., Dec. 2-3, 2022
JW Marriott Essex House, New York City
Information/registration: ccfcme.org/mitralvalve22

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