Cleveland Clinic

CardiacConsult

Heart, Vascular and Thoracic News from Cleveland Clinic | 2020 | Issue 3

› CARDIAC CONSULT FEATURE

Heart Failure Outcomes: Timely Referral Matters

Plus a heart transplant milestone – p. 3

Dear Colleagues,

When I learned this summer that Cleveland Clinic had been recognized as the nation's No. 1 cardiology and heart surgery program by *U.S. News & World Report* for the 26th straight year, it made me think of the ubiquitous "26.2" bumper stickers on the cars of marathon runners.

The association is an apt one, as the qualities that go into marathon success are many of the same ones behind excellence in clinical care and research — training, dedication and perseverance.

I am honored beyond measure to lead the team of caregivers and researchers in our Heart, Vascular & Thoracic Institute who have now been recognized for "going the distance" for our patients in an unsurpassed manner for 26 years strong.

The marathon metaphor applies just as well to our cover story on timely referral for heart transplant or LVAD placement for patients with advanced heart failure. The guidance in that article aligns with insights we've gleaned from performing more than 2,000 heart transplants over 36 years, with our 2,000th heart transplant completed in August of this year. Coincidentally, we also completed our 2,000th lung transplant a month earlier. Those are marathon efforts indeed.

We thank you, our clinical and research partners around the nation, for your abiding confidence and collaboration over the past 26 years. We remain committed to the training, dedication and perseverance that have taken us this far on our marathon journey. We promise to continue to bring those qualities to bear for complex cases you may entrust to us for consultation or referral.

Respectfully,

Lars G. Svensson, MD, PhD

CHAIRMAN | Sydell and Arnold Miller Family Heart, Vascular & Thoracic Institute

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

Medical Editor
Lars G. Svensson, MD, PhD
Institute Chair
svenssl@ccf.org

Managing Editor
Glenn R. Campbell

Art Director
Michael Viars

Marketing
Jackie Riggle | Colleen Burke | Suzanne Anthony

Photography & Illustrations
Cleveland Clinic Center for Medical Art & Photography
Russell Lee Photography

Cleveland Clinic was named a top U.S. hospital in *U.S. News & World Report*'s "Best Hospitals" rankings for 2020-21, as well as the No. 1 hospital in cardiology and heart surgery for the 26th consecutive year.

Stay Connected

consultqd.clevelandclinic.org/cardiovascular

clevelandclinic.org/cardiacconsult

@CleClinicMD

clevelandclinic.org/heartlinkedin

clevelandclinic.org/cardiacconsultpodcast

24/7 Referrals

855.REFER.123 | **clevelandclinic.org/heartreferrals**

Outcomes Online

clevelandclinic.org/hvtioutcomes

Clinical Trials

clevelandclinic.org/clinicaltrials

HEART FAILURE OUTCOMES:

Why Timely Referral for Transplant or LVAD Placement Is Critical

NEW *JACC* DOCUMENT GIVES GUIDANCE ON EVALUATION FOR ADVANCED THERAPIES.

Prompt referral of patients with heart failure for evaluation for transplantation or a mechanical circulatory support (MCS) device is central to successful outcomes. That's the key takeaway from a recent *Journal of the American College of Cardiology* Council Perspectives document (*J Am Coll Cardiol.* 2020;75:1471-1487) designed to (1) provide guidance on when a patient should be referred to a heart failure MCS center and (2) review characteristics for prioritizing heart transplantation versus placement of a left ventricular assist device (LVAD).

"Referral for advanced therapy for heart failure is often delayed to the point that a patient is no longer a good candidate for either a transplant or an LVAD placement," says Cleveland Clinic heart failure cardiologist Randall C. Starling, MD, MPH, a co-author of the article. "A primary goal of this statement is to provide cardiologists and internists with a better decision-making strategy to improve referral time."

Continued next page ›

A three-step process to referral

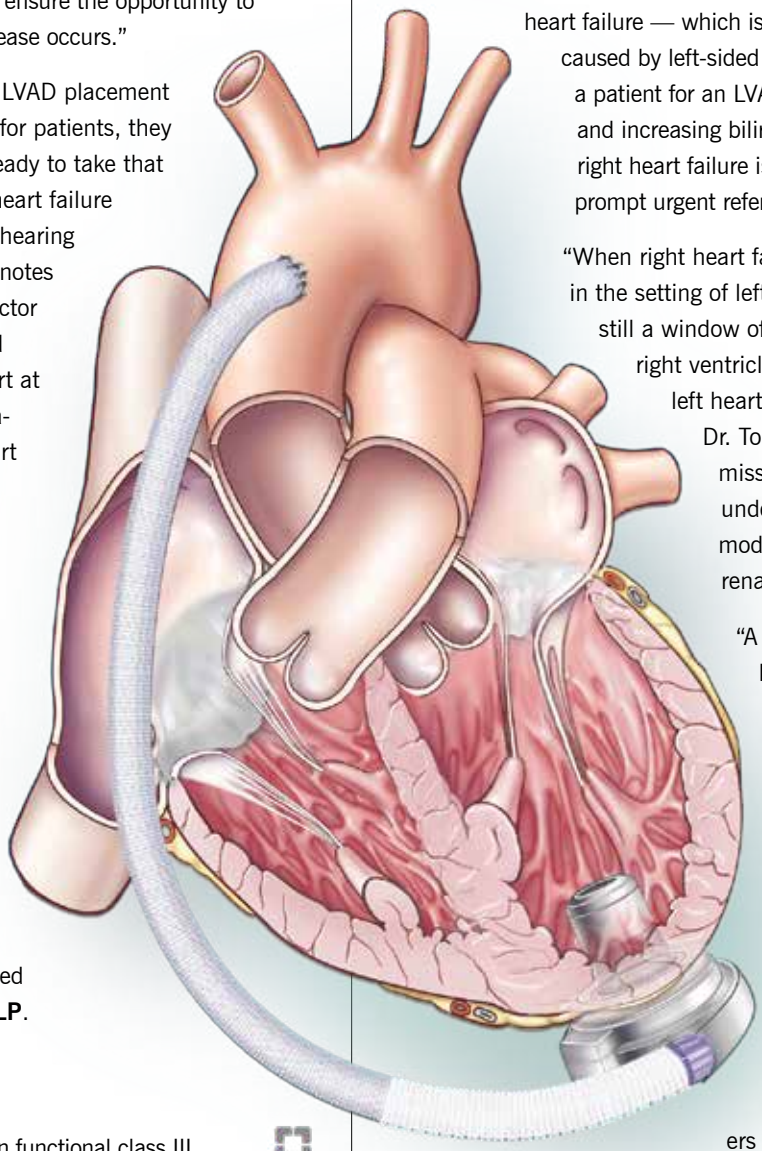
The article recommends structuring evaluation for referral around three overarching questions, as outlined below.

1. Is transplantation or durable assist device placement indicated? "All patients with features of low cardiac output syndrome should be considered for referral," advises Dr. Starling. "Early referral promotes ongoing evaluation and patient education. Most importantly, it helps ensure the opportunity to intervene before end-organ disease occurs."

"Since heart transplantation or LVAD placement is such a significant life event for patients, they may not always be mentally ready to take that step if they are presenting in heart failure and it's the first time they are hearing about the treatment options," notes Michael Tong, MD, MBA, Director of Cardiac Transplantation and Mechanical Circulatory Support at Cleveland Clinic. "Referring patients earlier and having a heart failure cardiologist co-manage a patient with their cardiologist or internist can help prepare patients and improve their understanding and acceptance of these advanced treatment options if and when the time comes."

While other guidance documents provide detailed indicators of the need for referral, the new document's authors recommend a simplified approach summarized by the mnemonic **I NEED HELP**. This stands for the following:

- **I**notrope requirements
- **N**ew York Heart Association functional class III or IV (or high natriuretic peptide levels)
- **E**nd-organ dysfunction (worsening renal or liver dysfunction)
- **E**jection fraction < 25%
- **D**efibrillator shocks (recurrent)
- **H**ospitalizations (at least one for heart failure in past year)
- **E**dema or escalating diuretic needs
- **L**ow blood pressure (systolic < 90-100 mmHg)
- **P**rognostic medications (inability to up-titrate or need to reduce heart failure drugs)



Dr. Starling urges doctors to keep in mind that right-sided heart failure — which is most often ultimately caused by left-sided failure — may disqualify a patient for an LVAD. "Persistent edema and increasing bilirubin levels — indicating right heart failure is developing — should prompt urgent referral," he warns.

"When right heart failure is first developing in the setting of left heart failure, there is still a window of opportunity when the right ventricle could recover if the left heart is supported," notes Dr. Tong. "If this window is missed, then the right heart undergoes irreversible remodeling, which can lead to renal and hepatic failure."

"A hospital admission for heart failure is a sentinel event," adds Edward Soltesz, MD, MPH, Surgical Director of Cleveland Clinic's Kaufman Center for Heart Failure Treatment and Recovery. "It should immediately raise a red flag for patients and providers. It is critical for caregivers to not minimize the severity and significance of this event and to work expeditiously to ensure appropriate referral to a specialist in advanced heart failure."

2. Are there contraindications to either intervention? There is no straightforward agreed-upon answer to this question in the scientific community, Dr. Starling cautions. Hence, a view of the whole patient is in order.

Insights Gleaned From **2,000** Heart Transplants

Recommendations from the new *JACC* Council Perspectives document (see main story) are well aligned with Cleveland Clinic's management practices for patients with advanced heart failure. That's due in no small part to Cleveland Clinic's deep experience in heart failure care, reflected in a major milestone in 2020: In August, Cleveland Clinic performed its 2,000th heart transplant to date — one of the highest cumulative volumes in the world. (Coincidentally, this feat comes on the heels of Cleveland Clinic's 2,000th lung transplant case, which took place in early July.)

Since Cleveland Clinic's formal heart transplant program was launched in 1984, patients of all types have benefited. That includes both old and young (the program performed its first successful pediatric heart transplant in 1985) and those requiring complex combined heart-lung, heart-kidney and heart-liver transplants.

The program's quality is validated by patient and graft survival rates that consistently exceed both national norms and expected rates (see data callouts below).

All potential transplant candidates benefit from the transplant program's integration with Cleveland Clinic's Kaufman Center for Heart Failure Treatment and Recovery to ensure a comprehensive and multidisciplinary approach to their care.

In many cases that includes consideration of placement of an LVAD or another MCS device. The Cleveland Clinic team has been implanting LVADs for three decades — with 101 placed in 2019 — and has participated in all major clinical trials of LVADs to date.

"Since the inception of our advanced heart failure program, Cleveland Clinic has been at the forefront of innovation, research and education while delivering untouchable quality and outcomes that are among the best in the world," says Michael Tong, MD, MBA, Director of Cardiac Transplantation and Mechanical Circulatory Support. "Every patient deserves a second chance to live their life to the fullest. We help give patients that chance every day."

"The success of our advanced heart failure program is best defined by excellent quality coupled with expedited access," adds Jerry Estep, MD, Section Head of Heart Failure and Transplantation. "We work as a team to evaluate patients to determine whether their condition has progressed to end-stage heart failure. This is a diagnosis we do not take lightly, given its poor prognosis. Most important, we decide the best next steps, which include consideration for a heart or heart/multiorgan transplant or a durable LVAD to improve quality of life and survival. Key to our process is working together with patients to make the best decision by balancing risks and expected outcomes with patient preferences and values."

Heart Transplantation at Cleveland Clinic: Numbers of Note

1968	Year of first heart transplant
1984	Year that formal heart transplant program was launched
94.6%	1-year patient survival, vs. 91.3% national benchmark
87.0%	3-year patient survival, vs. 84.7% national benchmark
35%	lower 1-year risk of graft failure relative to national benchmark
13%	lower 3-year risk of graft failure relative to national benchmark

(Source: Scientific Registry of Transplant Recipients program report of 1/7/20)

Continued next page ›

> "All patients with features of low cardiac output syndrome should be considered for referral. Early referral promotes ongoing evaluation and patient education. Most importantly, it helps ensure the opportunity to intervene before end-organ disease occurs."
>
> – Randall C. Starling, MD, MPH

Poor outcomes tend to be seen in patients with malnutrition (either cachexia or obesity), frailty, pulmonary hypertension with right ventricular failure, or systemic diseases associated with poor survival. Age greater than 70, a malignancy within five years and irreversible renal dysfunction are often considered potential barriers specifically for transplantation and require careful discussion by the heart failure care team.

"As treatment options and devices have improved over the years, many more patients are being offered treatment who would not have been considered good candidates before," says Dr. Tong. "Patients who may not be good candidates or have not met criteria for heart transplantation can still be good candidates for an LVAD."

3. Transplantation vs. LVAD: How to choose? Although heart transplant has the best record for reducing mortality and improving quality of life for patients with end-stage heart failure, the number of available organs remains a limiting factor. Fortunately, LVADs are a proven therapy that can dramatically improve survival and quality of life, and LVAD technology is continually improving, Dr. Starling notes. Evidence indicates

that two-year survival rates are now similar between the two options, although definitive long-term comparisons have yet to be conducted.

Choosing the best option can be a complex process that typically benefits from multidisciplinary heart failure team input. The authors advocate a strategy based on the following principles:

- For patients eligible for transplant but not LVAD placement, list for transplantation with no intention of LVAD implant. Biventricular or right ventricular failure favors the transplant option, as does intractable ventricular tachycardia.
- For patients eligible for both, list for transplantation but proceed to LVAD placement if the patient is unstable or has evidence of impending end-organ damage.
- For patients eligible for LVAD placement but not transplantation, implant a long-term LVAD. If the patient may be eligible for transplantation in the future, periodically reevaluate for this option.

"Keep in mind that this is a rapidly evolving field, and new rules and discoveries may change the outlook for patients over their lifetime," comments Dr. Starling.

"The key to success is early referral to a multidisciplinary heart failure team to map out a strategy for patients on an individual basis," adds Dr. Soltesz. "We want to intervene before the heart failure affects other organs and becomes irreversible."

Implications of organ allocation changes

The article also discusses implications of changes from the new organ allocation system adopted in October 2018, and it is the first document of its kind since then. Under the changes, listing allocation is essentially based on a tiered hierarchy from very ill hospitalized candidates to less ill outpatients awaiting transplantation.

"The changes were designed to address inequities in organ allocation and reduce the need for listing priority exception requests," says Dr. Starling. In the previous system, he explains, certain populations were at a disadvantage, prompting abundant exception requests.

Historically, the use of MCS as a bridge to transplantation increased substantially over the years, which the old system was ill-equipped to address. Geographic distribution alterations were also made with the new system. "It remains to be seen exactly how the new system will play out," Dr. Starling concludes. ■

Contact Dr. Starling at 216.444.2268, Dr. Tong at 216.445.0807, Dr. Soltesz at 216.444.5680 and Dr. Estep at 216.444.7646.

Reigniting Clinical Research in the Wake of a Pandemic

Cleveland Clinic's Miller Family Heart, Vascular & Thoracic Institute (HVTI) was actively recruiting patients for at least 75 clinical trials when COVID-19 arrived in the U.S. Institution-wide changes made to protect patients, clinicians and research staff from unnecessary risk triggered a cascade of events impacting every aspect of clinical trial operations. Most trials came to a halt while physicians and research administrators identified obstacles and implemented solutions that would allow studies to resume as quickly as possible.

"We had to find ways to maintain the integrity of our clinical research program and jump-start the trials, which was a challenge in the setting of so many restrictions," says Samir Kapadia, MD, Chair of Cardiovascular Medicine at Cleveland Clinic.

Initial challenges and responses

On March 18, Cleveland Clinic halted nonessential procedures and nonurgent outpatient appointments. This meant the lion's share of clinical trial participants could no longer be seen in person. Clinical research staff were faced with developing alternative methods for screening, consenting, treating and evaluating hundreds of patients.

"We went from in-person to virtual visits overnight," says Denise Kosty Sweeney, MSN, RN, Research Administrator for HVTI. "It was a challenge figuring out how to consent patients virtually and teach them how to use the technology."

Virtual visits were sufficient for evaluating some clinical trial participants, but not all. To gather requisite data that could not be obtained virtually, Cleveland Clinic enlisted clinicians to visit patients' homes, where they conducted physical exams and echocardiograms and obtained blood for lab testing.

Distribution of study drugs was a major hurdle. Medications could be delivered to in-state patients via Cleveland Clinic's pharmacy services, but arrangements had to be made for study sponsors to ship medications to participants outside Ohio.

In mid-April, sponsors formally suspended some 60% of cardiovascular trials that Cleveland Clinic was involved in. "At this point, we went through our studies and identified the ones that could continue," says Kosty Sweeney. These included studies providing new treatment options for patients undergoing essential procedures, including aortic valve replacement and nonelective stenting.

Scaling solutions for multicenter studies

While protocols to accommodate Cleveland Clinic patients were being revised, adjusting multisite national and international trials posed a different set of problems for the Cleveland Clinic Coordinating Center for Clinical Research (C5Research). As one of the nation's leading academic research organizations in the cardiovascular field, C5Research designs, plans and manages large multicenter trials.

Sites were impacted by COVID-19 to varying degrees, according to C5Research Director A. Michael Lincoff, MD. "The national site coordinators within each country have been reaching out to struggling sites to help with local pandemic-related issues," says Dr. Lincoff, who also serves as Vice Chair for Clinical Research in Cleveland Clinic's Department of Cardiovascular Medicine. "We arrange for them to have regular discussions with trial sponsors about how to overcome these issues."

For clinical trials still in the early stage, virtual meetings with site coordinators and staff were substituted for in-person visits. However, the virtual platforms adequate for small group discussions proved problematic for large meetings. "We had to find a new platform that provided high-quality video and audio, could accommodate large meetings and had good connectivity with overseas sites," explains Ruth Cannata, BSN, RN, Director of Operations for C5Research.

A staged resumption

While changes in protocol were designed to keep as many clinical trials as possible on track, the ultimate goal was to return to normal operations when Cleveland Clinic resumed elective procedures and nonurgent outpatient visits. For the sake of patient safety, this was undertaken in stages.

"We analyzed our trials to see what it would take to minimize patient exposure to COVID-19, and we decided to start with low-risk studies," explains Dr. Kapadia. "These involve

"There is tremendous potential for missing and distorted data. Patients who die because they are afraid to go to the hospital may be lost to follow-up, or the cause of death may end up being unobtainable." – A. Michael Lincoff, MD

patients who don't need to travel or undergo any testing other than what is considered standard of care." These low-risk trials resumed in early June.

In mid-June, trial-related visits resumed for study participants who were undergoing testing solely for research, not as part of routine care. As of mid-July, healthy individuals could be enrolled as control subjects in a trial if they were present at a Cleveland Clinic facility for other reasons (e.g., as a Cleveland Clinic employee, a student or a family member accompanying a patient).

Resuming multicenter trials administered through C5Research has been more complex. "We are modifying protocols as necessary, reactivating sites globally and enrolling new sites as they are permitted," says Dr. Lincoff.

Ensuring data integrity

As clinical trial activity ratchets up under new conditions, one overarching concern remains: How will outcomes and data interpretation be affected?

"There is tremendous potential for missing and distorted data," Dr. Lincoff cautions. "Patients who die because they are afraid to go to the hospital may be lost to follow-up, or the cause of death may end up being unobtainable. For instance, if a patient died of COVID-19 and had elevated troponin levels, can we know whether or not they had a myocardial infarction?"

"Losing patients to follow-up would have a huge impact on the credibility of a study and the interpretation of data," adds Dr. Kapadia. "This is why our investigators pursue every contact and every avenue to achieve 100% follow-up."

That aggressive approach is paying off. During the pandemic, C5Research wrapped up the 13,000-patient international STRENGTH trial in patients with mixed dyslipidemia, obtaining vital statistics in 99.8% of participants and follow-up in 96.6%.

"I'm proud of what we were able to achieve," says HVTI Chief Academic Officer Steven Nissen, MD, who served as study chairman for the STRENGTH trial.

A strong shift toward COVID-19 research

Reduced patient activity during the early weeks of the pandemic had one silver lining: It gave HVTI staff more time to do research. When Cleveland Clinic's institutional review board (IRB) announced it would prioritize research projects related to COVID-19, ideas poured in at an unprecedented rate.

"The Office of Sponsored Research said, 'Get the trials done. We'll worry about funding later,'" notes Dr. Lincoff.

As a result, 42 COVID-19-related studies by HVTI staff have been added since March, including five prospective interventional trials.

Some changes are likely to endure

Despite the stress of reorganizing trial processes overnight, some of the changes instituted during the pandemic have improved the way clinical trials are run. "Like everyone else, we had some processes that were outdated, but there was inertia against change because clinical trials are so highly regulated," Dr. Lincoff says. "COVID-19 forced us to make changes with the blessing and encouragement of the FDA."

For instance, virtual visits are likely to be retained for clinical trial participants. "They make better use of physicians' and coordinators' time," Dr. Lincoff says. "Patients don't have to travel, and it's easier to keep them engaged. Interactions between sponsors and sites are more efficient as well."

While there is no lack of enthusiasm for research in Cleveland Clinic's HVTI, the IRB has gone to great lengths to keep up. Before any trial can resume, an application to restart must be submitted and reviewed. This has required committee members and staff of the IRB to meet two or three times a week.

"Every week we evaluate more trials," says Dr. Kapadia. "We're fired up about getting them resumed and initiating new ones." ■

Contact Dr. Kapadia at 216.444.6735, Dr. Lincoff at 216.444.2367 and Dr. Nissen at 216.445.6852.

SAVR in the TAVR Era: Should 'Low Surgical Risk' Be Redefined?

Cleveland Clinic review finds an STS-PROM score < 4% overestimates adverse outcomes.

Relying on the Society of Thoracic Surgeons Predicted Risk of Mortality (STS-PROM) score to determine surgical aortic valve replacement (SAVR) candidacy may deny many patients safe surgery, as the low-risk score (< 4%) overestimates risk. That's the conclusion of a Cleveland Clinic review of isolated SAVR procedures that found rates of mortality, permanent stroke, extended hospital stays and other adverse measures to be lower than expected from the STS-PROM model.

The research was reported as a plenary presentation at the virtual 2020 annual meeting of the American Association for Thoracic Surgery, held May 22-23.

"Our data support early surgery and provide a benchmark for comparing real-world transcatheter outcomes," says study presenter Douglas Johnston, MD, a Cleveland Clinic cardiothoracic surgeon.

SAVR vs. TAVR: Never an easy decision

Recommendations for managing aortic stenosis continue to evolve. American Heart Association/American College of Cardiology guidelines for managing patients with valvular heart disease suggest that SAVR is a reasonable option in asymptomatic patients with low surgical risk and decreased exercise tolerance or rapid progression.

But two 2019 randomized trials, the Evolut Low-Risk Trial (*N Engl J Med.* 2019;380:1706-1715) and the PARTNER 3 trial (*N Engl J Med.* 2019;380:1695-1705), found short-term equivalence between transcatheter AVR (TAVR) and SAVR in patients with an STS-PROM score of less than 4%.

"SAVR may offer advantages that these trials fail to capture, especially for young, otherwise healthy patients who want to enjoy an active lifestyle for decades to come," says Dr. Johnston. "Basing the decision on the STS-PROM score may not reflect current real-world SAVR risk."

Study design and findings

This study included 3,493 adults (mean age, 64 ± 13 years) who underwent isolated SAVR at Cleveland Clinic between January 2005 and January 2017. All had an STS-PROM score of less than 4%, with the median score being approximately 1.2% throughout the study period.

Operative approach and choice of prosthesis were according to surgeon discretion. About 40% of patients underwent a minimally invasive incision. Prostheses implanted with a full root technique (e.g., allografts) were not included, as they are excluded from the STS definition.

In-hospital outcomes were as follows, with observed results listed first followed by results as predicted by the STS-PROM model and the *P* value for the difference:

- Operative mortality, 15 (0.43%) vs. 55 (1.6%), $P < 0.0001$
- Permanent stroke, 26 (0.74%) vs. 40 (1.2%), $P = 0.02$
- Renal failure, 52 (1.5%) vs. 97 (2.8%), $P < 0.0001$
- Prolonged ventilation, 149 (4.3%) vs. 249 (7.1%), $P < 0.0001$
- Deep sternal wound infection, 6 (0.17%) vs. 8 (0.23%), $P = 0.5$
- Reoperation, 116 (3.3%) vs. 230 (6.6%), $P < 0.0001$
- Major morbidity or mortality (composite adverse event), 278 (8.0%) vs. 449 (12.9%), $P < 0.0001$
- Prolonged length of stay (> 14 days), 129 (3.7%) vs. 165 (4.7%), $P = 0.004$

"For all outcome measures, our experience was better than expected by STS-PROM," Dr. Johnston notes. "This calls into question how well this prediction model reflects current realities for low-risk SAVR."

Detailed analysis revealed that the observed risks of operative mortality and morbidities were less than expected for each decile of the score, with the differences greater at the higher end of the 0%-4% risk spectrum.

Multivariate analysis identified the following significant risk factors for mortality or major morbidity: mitral regurgitation, left ventricular septal thickness, higher bilirubin level, lower creatinine clearance and chronic obstructive pulmonary disease.

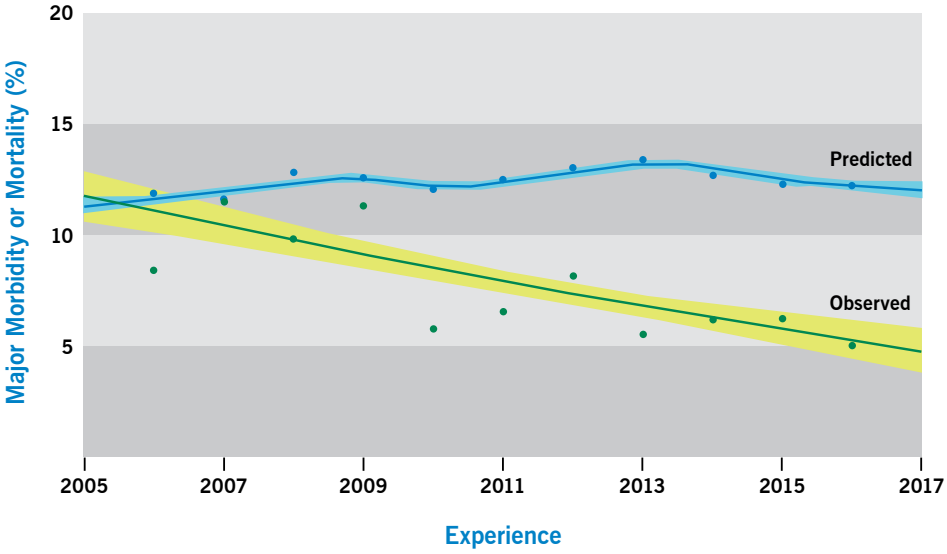


Figure. Temporal trend of observed and predicted STS major morbidity or mortality after SAVR.

Reprinted from Johnston D, et al., "Redefining 'Low Risk': Outcomes of SAVR in Low Risk Patients in the TAVR Era," plenary presentation at the virtual annual meeting of the American Association for Thoracic Surgery (AATS), May 22-23, 2020, with permission from AATS.

Earlier date of surgery was also an identified risk factor, reflecting the length of the study period, during which surgical techniques improved. In the first years of the study, expected and observed outcomes were closely correlated; however, observed morbidity and mortality declined dramatically while predicted risk did not (Figure). Observed mortality was zero in the last four years of the study period.

Long-term survival of patients compared favorably with U.S. census-matched controls. Freedom from reoperation was 95% at seven years.

Conclusion: Early SAVR safe for low-risk patients

Dr. Johnston highlights the following key takeaways from this study:

- **STS-PROM score overestimates risk in contemporary practice.** For patients with a score less than 4%, SAVR was found to be associated with extremely low risk. Dr. Johnston says the surgical community's ability to evaluate risk is continually evolving. "We need an agile, real-time quality assessment of SAVR practice that accounts for ongoing improvements in techniques and technology," he says, noting that differences between observed and predicted mortality and complication rates are increasing with time.
- **Data support early surgery for aortic stenosis in patients with an STS-PROM score < 4%.** "SAVR can be considered for patients who may not reach classic criteria for intervention but who want to maintain an active lifestyle or have careers that demand it," he observes. Early SAVR can also help prevent poor outcomes from delayed surgery, especially as left ventricular hypertrophy was identified as a risk factor. "New strain imaging models may one day contribute to better decisions regarding timing of surgery in asymptomatic patients," Dr. Johnston adds.
- **Patient selection and institutional factors matter.** Because this study reflects the experience of a single high-volume institution, outcomes may not be widely applicable. Also, the Cleveland Clinic population tended to be younger than participants in the PARTNER 3 trial, and some comorbidities differed that also may have lowered risk.

"Our intention was not to pit SAVR versus TAVR but to recognize that risk is a moving target as technologies advance," Dr. Johnston observes. "Our study reassured us that for asymptomatic patients with aortic stenosis, SAVR remains a reasonable intervention with an excellent long-term outcome."

In comparing outcomes between SAVR and TAVR in the trials of low-risk patients, Lars Svensson, MD, PhD, Chair of Cleveland Clinic's Heart, Vascular & Thoracic Institute, points out that 26% of SAVR patients in the PARTNER 3 trial underwent an additional cardiac operation, mostly coronary artery bypass. "Thus, the PARTNER 3 data comparing TAVR with SAVR should be interpreted with caution," he says. "Furthermore, more recent data reported from the PARTNER trials show a concerning increase in strokes and death in the TAVR research arms when compared with SAVR. Hence, we advocate SAVR at Cleveland Clinic in low-risk patients based on our results, particularly for patients younger than age 65 and for patients with a bicuspid valve, an aorta larger than 4.5 cm, or concomitant problems such as coronary disease, other diseased valves (such as the mitral valve) or other cardiac problems." ■

Contact Dr. Johnston at 216.444.5613 and Dr. Svensson at 216.444.6962.

Guideline Update on Primary CVD Prevention in Women Takes on Conventional and Sex-Specific Risks

Hypertensive disorders of pregnancy and gestational diabetes mellitus (DM) put women at elevated risk for cardiovascular disease (CVD) later in life, and early primary prevention to address these and other conditions unique to women can improve eventual outcomes. So contends a new *Journal of the American College of Cardiology (JACC)* State-of-the-Art Review (2020;75:2602-2618) summarizing updated recommendations for the primary prevention of CVD in women.

The document, developed by the ACC's Cardiovascular Disease in Women Committee, is an update to a 2011 guideline update on the topic from the American Heart Association (AHA), which covered only conventional CVD risk factors.

"A plethora of evidence pertaining to women's cardiovascular risk has emerged in the past decade, enabling *JACC* to issue the first comprehensive guideline detailing women's unique risk factors with recommendations for primary prevention," says lead and corresponding author Leslie Cho, MD, Director of the Women's Cardiovascular Center and Co-Section Head of Preventive Cardiology and Rehabilitation at Cleveland Clinic.

In addition to covering risks specific to women, the new update discusses traditional CVD risk factors, with an emphasis on distinct manifestations and treatment responses in women. Multiple tables and figures concisely summarize key points and management strategies.

Risk factors particular to women

The review discusses — and provides treatment recommendations for — the following disorders that are unique to or likelier to occur in women:

- **Pregnancy-related disorders.** Hypertensive disorders of pregnancy, gestational DM, preterm birth, pregnancy loss and having a baby with low birthweight for gestational age are associated with developing later CVD. This is especially significant when such complications occur in younger pregnant women, at an age before conventional CVD risk factors usually manifest. "At Cleveland Clinic, pregnant women who have preeclampsia or diabetes in pregnancy are automatically flagged for follow-up in the electronic medical record," says Dr. Cho, shown at left. "This provides the opportunity to conduct a thorough risk assessment and counsel women on lifestyle choices."

"Many of the conditions unique to women arise decades before cardiovascular disease manifests itself. This creates a huge window of opportunity to take proactive measures that can make a real difference in outcomes." – Leslie Cho, MD

- **Polycystic ovarian syndrome.** Women with this condition are prone to developing metabolic syndrome, which contributes to endothelial dysfunction and subclinical atherosclerosis. Menstrual irregularities should be treated, and metformin is recommended for insulin resistance. Women should be monitored every six to 12 months for weight changes, blood pressure, and fasting lipid and blood sugar levels.
- **Autoimmune and inflammatory conditions.** Women are more likely to have diseases such as systemic lupus erythematosus and rheumatoid arthritis, which are associated with accelerated atherosclerosis and coronary vascular dysfunction. "Eighty percent of patients who have autoimmune disease are women, and they need aggressive risk factor modification," notes Dr. Cho.

"Many of the conditions unique to women arise decades before cardiovascular disease manifests itself," she adds. "This creates a huge window of opportunity to take proactive measures that can make a real difference in outcomes."

Traditional risks: How women differ

The updated guideline also examines how the following traditional CVD risk factors affect women in different ways than men:

- **Hypertension.** Obesity is the most significant risk factor for developing hypertension among women. Dr. Cho notes that thiazide diuretics may be an ideal antihypertensive medication choice for women with osteoporosis because these drugs reduce calcium excretion and thereby lower osteoporotic fracture risk.
- **Blood cholesterol.** No sex-specific guidelines exist for managing hyperlipidemia with statins, but statins' role for women has been controversial, and women are less likely to receive guideline-recommended therapy. Since the 2011 AHA guideline update, two large meta-analyses that included over 40,000 women demonstrated that statin therapy offers similar benefit to men and women for both primary and secondary prevention, and for all levels of risk in primary prevention. The new *JACC* review includes tables on statin recommendations for women for primary and secondary prevention and during pregnancy.
- **Diabetes mellitus.** Whereas rates of type 2 DM are higher in girls than in boys, once midlife arrives, incidence rates in men exceed those in women. Rates are similar between the sexes in later life. "Diabetes nearly cancels the gender gap between men and women in development of cardiovascular disease," says Dr. Cho. "Especially for women who develop the disease early, there is longer exposure to insulin resistance and its attendant harms." She emphasizes that the increased CVD risk associated with DM requires aggressive risk factor reduction, but studies consistently show DM to be underdiagnosed and undertreated in women, resulting in poorer control of traditional risk factors. The review provides a table of DM risk management and treatment goals, and it notes two gender differences in responses to medications: (1) glucagon-like peptide-1 receptor agonists provide better glycemic control in men, although women tend to benefit from greater weight loss; (2) thiazolidinedione medications control blood sugar better in obese women.

Personalized treatment for better outcomes

The new guideline update also covers anticoagulation therapy for atrial fibrillation, aspirin therapy, perimenopausal hormone therapy and psychosocial issues.

"Cardiovascular disease is preventable in 90% of cases," concludes Dr. Cho. "Tailoring management with a knowledge of important gender differences helps providers optimize patient care." ■

Contact Dr. Cho at 216.445.6320.

A Longtime Alliance Partner Sees Benefits From Collaboration on Clinical Projects and Beyond

Initiatives cover everything from STS performance metrics to facility renovations.

Since the inception of the alliance between MedStar Union Memorial Hospital (MUMH) and Cleveland Clinic's Miller Family Heart, Vascular & Thoracic Institute in 2013, the Baltimore-based hospital has undertaken numerous collaborative endeavors related to quality improvement and strategy implementation. Focus areas have included increasing productivity and efficiency, improving workforce utilization and implementing cost containment strategies. Additionally, MUMH has embarked on a journey with Cleveland Clinic to improve the overall quality of care it delivers to its local community.

This article profiles two initiatives carried out under the MUMH-Cleveland Clinic alliance, each demonstrating how the collaboration supports MUMH's strategic goals and dedication to continuously enhancing patient safety.

Putting a check on prolonged ventilation rates

Appropriate ventilator weaning and extubation following cardiac surgery decreases the risk for postoperative complications. Accordingly, risk-adjusted postoperative prolonged intubation (prolonged ventilation) is an established performance metric in the Society of Thoracic Surgeons (STS) Adult Cardiac Surgery Database. The metric represents the percentage of patients undergoing cardiac surgery who require intubation for more than 24 hours after exiting the OR. Upon initial assessment by Cleveland Clinic, MUMH's prolonged ventilation rates were above national benchmarks and not consistent with MUMH's strict standards for quality care.

To improve this metric, MUMH enlisted Cleveland Clinic postoperative clinical consultants to do the following:

- Evaluate MUMH workflows for weaning patients from post-cardiac surgery mechanical ventilation
- Assess its care team's knowledge of how prolonged ventilation is defined by the STS
- Review its STS registry data to identify opportunities for avoiding prolonged ventilation and thereby improve performance on this metric

Through monthly work plan calls, annual on-site evaluations of postoperative care and quarterly STS data analysis, a continuous improvement plan was developed and implemented by MUMH in collaboration with Cleveland Clinic consultants. In addition to addressing issues such as handoff communications and education of the postoperative care team, MUMH

Trend in Prolonged Ventilation Rates Among MUMH Cardiac Surgery Patients (All Procedures)

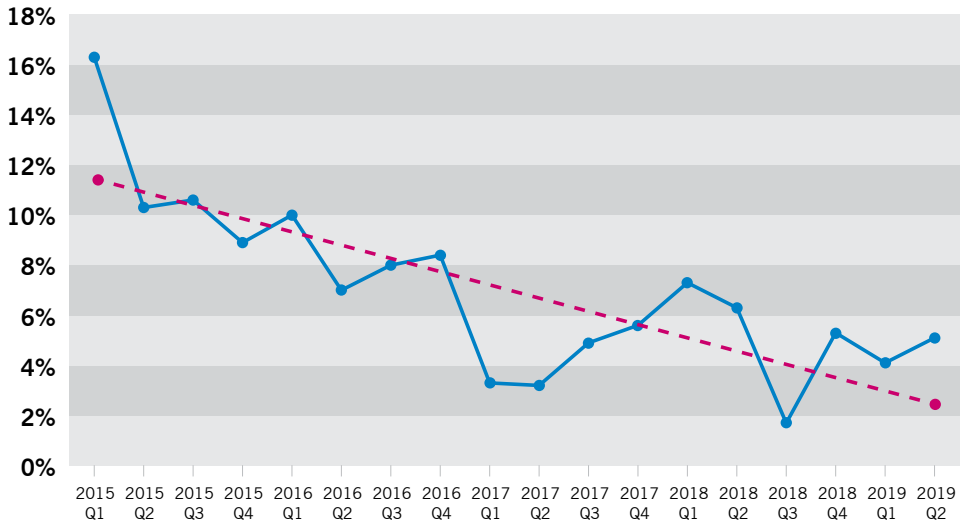


Figure. Rates of prolonged ventilation over time for MUMH patients undergoing all categories of cardiac surgery (coronary artery bypass grafting [CABG], valve, combined valve/CABG, other).

revised multidisciplinary rounding practices. It also instituted real-time tracking of the prolonged ventilation metric to identify the primary reason(s) for failure to reach targets and to trend metric data over time.

The postoperative care team successfully modified their process for handoff communication between the OR and ICU teams to ensure discussion of mechanical ventilation weaning and extubation expectations as well as extubation-time goals, using guidance from existing respiratory therapy protocols. The formats of daily multidisciplinary rounds and nurse-to-nurse handoff reports were modified to raise awareness of how much time remained before a patient would exceed 24 hours of intubation and to prompt development of a patient-specific plan for liberation from mechanical ventilation if appropriate.

Implementation of these recommended practices and real-time data tracking was associated with a 69% relative improvement in rates of prolonged ventilation among patients undergoing any cardiac surgery procedure, from 16.3% at the start of the initiative in Q1 2015 to 5.1% in Q2 2019 (Figure).

"Our team enjoys working with the Cleveland Clinic group," says Cheryl Lunnen, Vice President, MedStar Heart & Vascular Institute at MUMH. "They are clinicians who understand real operational issues experienced by the staff, and together we come up with working solutions. Decreasing the extubation rate is just one example."

Sharing deep experience in EP lab renovation

In the autumn of 2018, the MUMH cardiovascular medicine administrative team started reviewing plans to renovate and update two of their electrophysiology (EP) labs. For help, they looked to Cleveland Clinic's Section of Cardiac Electrophysiology and Pacing to review their blueprints and equipment list prior to the renovation. In the past 10 years, Cleveland Clinic has renovated six of the eight EP labs on its main campus, so the MUMH team welcomed the opportunity to tap their recent experience. Through emails and conference calls, key insights and recommendations were provided on the renovation plans and equipment needs of the new laboratories. Specific recommendations were wide-ranging, addressing issues such as fluoroscopy software, surgical lighting packages and placement, boom placement and mapping equipment software.

The MUMH team found the recommendations extremely helpful and reported that they reduced MUMH's construction and equipment costs. "Working with Cleveland Clinic allowed us to create EP labs that were completely redesigned from the originals," says MUMH's Lunnen. "Because we had their expertise, minimal changes were necessary in construction and we now have labs that will take us into the future" (see photo of one of the renovated labs at left).

Partnering on clinical projects and more

"These initiatives are examples of the many projects completed over the past seven years by MUMH and Cleveland Clinic's Heart, Vascular & Thoracic Institute (HVTI) Strategic Operations Affiliate/Alliance Team," says Suma Thomas, MD, MBA, Vice Chair, HVTI Strategic Operations. "We are engaged in a collaborative partnership that approaches complex issues in a transparent and efficient manner. Whether working on clinical or nonclinical projects, the affiliate/alliance relationship enables hospital teams to use their resources and past experiences to facilitate change and provide superior patient care."

"Using industry-proven continuous improvement techniques such as Lean Six Sigma, our team of consultants leverages their deep knowledge and experience to provide alliance hospitals like MUMH with well-rounded recommendations in a variety of areas," adds Edward Soltesz, MD, MPH, Director of Cardiac Surgery Affiliate and Alliance Programs. "These detailed insights yield actionable efforts to drive down cost while improving quality, patient flow and overall service line excellence." ■

For information on affiliation and alliance opportunities with Cleveland Clinic's Heart, Vascular & Thoracic Institute, visit clevelandclinic.org/heartaffiliates or email HVI_Strategic_Operations@ccf.org.

Drain Placement After Carotid Endarterectomy:

It Doesn't Curb Complications and Actually Prolongs Hospital Stay

Drain placement following carotid endarterectomy (CEA) does not lower rates of perioperative death, stroke or return to the operating room (OR) for bleeding but is instead associated with prolonged hospital stay. So finds an analysis from the Society for Vascular Surgery's Vascular Quality Initiative (VQI) of nearly 48,000 patients who underwent CEA with or without drain placement. The study was published in the *Journal of Vascular Surgery* (2020;72:204-208).

"The results of this study have altered the way we view drains for CEA at Cleveland Clinic," says the article's lead and corresponding author, Christopher Smolock, MD, a Cleveland Clinic vascular surgeon. "I have switched from always placing a drain following carotid endarterectomy to rarely doing so."

A common but unstudied practice

At many institutions, drains have been considered necessary after CEA to reduce hematoma formation and complications. As the study authors note, every surgeon has his or her own policy about placing them: Some do so routinely, some never do and others do so depending on circumstances. Despite the fact that drain placement after CEA is a common practice, no evidence supports its use.

Study design and results

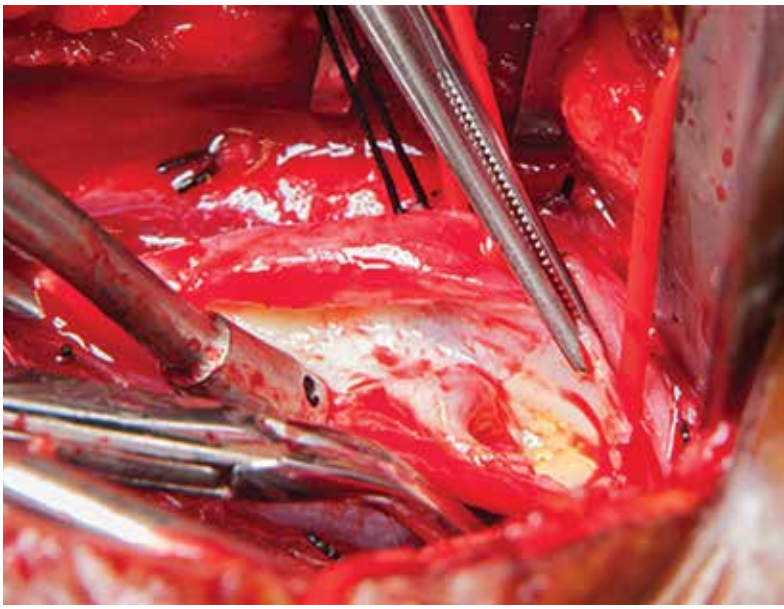
Dr. Smolock and colleagues from Cleveland Clinic searched the VQI registry to identify all patients who underwent CEA from 2011 to 2015. Of 47,752 patients identified, 19,425 (40.7%) had a drain placed and 28,327 (59.3%) did not.

Drain placement after CEA did not prevent the following two primary outcomes:

- Return to the OR for bleeding, which occurred in 0.83% of patients with no drain placement versus 1.0% of those with drain placement ($P = 0.024$ in favor of no drain placement)
- Postoperative wound infection, which occurred in 0.1% of patients with no drain placement versus 0.07% of those with drain placement ($P = 0.42$)

Moreover, hospital length of stay was found to be longer in patients with drain placement compared with no drain placement (2.4 ± 9.4 days vs. 2.1 ± 9.0 days; $P < 0.001$).

In addition, among patients who returned to the OR for bleeding, drain placement did not significantly affect rates of stroke, 30-day mortality, or combined mortality or stroke at 30 days, all of which were numerically lower among patients who did not undergo drain placement.



Across the overall cohort, the following factors were found to be significant predictors of returning to the OR for bleeding:

- Drain placement ($P = 0.024$)
- Chronic obstructive pulmonary disease ($P = 0.024$)
- Preoperative anticoagulant use ($P < 0.001$)
- Reexploration of the carotid artery after closure ($P < 0.001$)
- Preoperative P2Y12 antagonist use ($P < 0.001$)
- Absence of protamine use ($P < 0.001$)

The last three factors above — reexploration of the artery, preoperative P2Y12 antagonist use and lack of protamine use — were predictors of return to the OR for bleeding specifically among the subset of patients with drain placement.

> "Selective drain placement has played a part in creating a care pathway for shortened length of stay. We have reduced this length of stay from an average of 2.5 days to 1 day." – Christopher Smolock, MD

Baseline differences didn't change outcomes

Patients in the two study arms differed in some baseline and intraoperative factors. Those with drain placement were significantly more likely than those without to be male, to be taking a preoperative P2Y12 antagonist, to have had prior CEA or carotid artery stenting, to undergo a concomitant coronary artery bypass graft or other arterial procedure, to receive dextran, and to not receive protamine ($P < 0.001$ for each factor). Despite these differences, the major study findings remained unchanged after analysis of similarly matched patients.

CEA is a procedure with rare but high-risk consequences

Dr. Smolock notes that while bleeding events that required a return to the OR occurred in less than 1% of study patients, the potential consequences — i.e., stroke and death — can be devastating.

"Various strategies have been tried to reduce the chance that a patient will need to return to the OR, but many of these strategies have no evidence to back them up," he says.

Although complication rates are low for drain placement, he adds, patient comfort and satisfaction — reflected in shorter hospital stays — are also important to consider.

Practice-changing findings

According to Dr. Smolock, this study emphasizes that drains are not a substitute for hemostasis prior to operative closure. In the past few years, Cleveland Clinic surgeons have more selectively placed drains after CEA, especially for reoperations and after complex operations involving an elevated risk of bleeding or other fluid leakage. "Selective drain placement has played a part in creating a care pathway for shortened length of stay," Dr. Smolock notes. "We have reduced this length of stay from an average of 2.5 days to 1 day."

Further research into CEA practice

He adds that a Cleveland Clinic research team is now evaluating the optimal timing of CEA within the treatment course for carotid artery stenosis and whether CEA might perhaps not be needed in some cases in which it is currently performed. The investigators will compare outcomes data from Cleveland Clinic patients with de-identified outcomes from other centers using the VQI registry.

"This study shows it's worthwhile to examine practices that have become entrenched as standard of care based on good intentions rather than data," observes Sean Lyden, MD, Chair of Vascular Surgery at Cleveland Clinic. "In the absence of data, it's never a mistake to ask good research questions." ■

Contact Dr. Smolock at 216.445.4787 and Dr. Lyden at 216.444.3581.

> "This study shows it's worthwhile to examine practices that have become entrenched as standard of care based on good intentions rather than data." – Sean Lyden, MD

Mastering the Mitral Valve: A Popular Course Goes Virtual This December

Mastering the Mitral Valve: A Case-Based Approach (Virtual Course)

Livestreamed Fri.-Sat., Dec. 4-5, 2020
(complimentary registration)
Register at ccfcme.org/mitralmasters

For the past few years, New York-area physicians have had convenient access to well-received Cleveland Clinic CME courses on heart valve care held in central Manhattan over a Friday and Saturday in early December. While the in-person version of the 2020 installment of that series, "Mastering the Mitral Valve: A Case-Based Approach," has been canceled due to the pandemic, the course is still very much alive and will be available to a larger audience than ever via livestream with complimentary registration.

"The silver lining of having to forgo the in-person offering of this popular course is that we can now extend its reach to many more physicians and other providers around the world — and with no registration fee," says course co-director A. Marc Gillinov, MD, Chair of Thoracic and Cardiovascular Surgery at Cleveland Clinic.

Briskly paced, highly case-based

Across a full day on Friday, Dec. 4, and the morning of Saturday, Dec. 5, 18 mitral valve experts from Cleveland Clinic and several other leading U.S. institutions will bring participants fully up to speed on contemporary management of mitral valve disease.

The livestreamed course is briskly paced — nearly all presentations are in focused 15-minute segments — and decidedly case-based. In fact, two of the six broad topical sessions are devoted solely to complex cases. Three of the other four sessions — on basic to advanced imaging, surgery and surgical decision-making, and new insights into mitral valve disease pathophysiology — feature a generous offering of cases throughout to guide real-world application of the latest evidence and advances. An additional session covering transcatheter mitral valve repair and replacement is less case-based but is rich with updates on new technologies and ongoing clinical trials.

"This program is designed to provide a practical, highly case-based approach to both the fundamentals of mitral valve disease care and cutting-edge approaches," says course co-director Milind Desai, MD, Director of Operations in Cleveland Clinic's Department of Cardiovascular Medicine. "We will focus on applying recent insights to specific patient populations and treatment dilemmas."

A sampling of presentation titles gives a glimpse of the course's practicality:

- How to Use Hemodynamic Measurements in Management of Patients with Mitral Regurgitation (MR)
- Irreparable Mitral Valve: Which Prosthesis to Choose?
- Intraoperative Imaging and Decision-Making in the OR: Problems to Recognize
- Surgical Treatment of Ischemic MR: Repair or Replace?
- Patient Selection for MitraClip in Heart Failure with Functional MR: Using the COAPT Criteria

Attention to collaboration, special topics

"Another focus is defining the role of transcatheter and surgical therapies, with an emphasis on the collaborative nature of these procedures across many cardiovascular disciplines," notes course co-director Samir Kapadia, MD, Cleveland Clinic's Chair of Cardiovascular Medicine. Updates will be provided on topics such as valve-in-valve/valve-in-ring procedures and appropriate patients for new trials of transcatheter mitral valve replacement, often from experts leading the trials or pioneering the techniques discussed.

The course's comprehensive nature allows for exploration of many special topics in relation to mitral valve disease, including anticoagulation, concomitant tricuspid valve disease, strategies to address atrial fibrillation during mitral valve surgery, radiation-related disease and reoperative mitral valve surgery, among others.

"Attendees of our past December courses in New York on mastering aortic and mitral valve disease can expect the same mix of expert updates, illuminating case studies and spirited panel discussions from this year's livestream offering," says course co-director Lars Svensson, MD, PhD, Chair of Cleveland Clinic's Heart, Vascular & Thoracic Institute. "Despite the circumstances for needing to go virtual, we are excited to be offering this year's course to many more colleagues who can participate in and learn from it."

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

In Case You Missed It

A sampling of recent studies and publications of note from our Heart, Vascular & Thoracic Institute staff*

Kalra A, Reed GW, et al. Incidence of stress cardiomyopathy during the coronavirus disease 2019 pandemic. *JAMA Network Open.* Epub July 9, 2020.

Bottom line: There was a significant increase in stress cardiomyopathy incidence in the early months of the COVID-19 pandemic vs. prepandemic control periods.

Bakaeen FG, Svensson LG. PCI or CABG for left main coronary artery disease [letter]. *N Engl J Med.* 2020;383:292.

Bottom line: In the EXCEL trial, the PCI treatment group was homogeneous whereas the CABG group had important variations that should be factored into interpretation of data findings.

Gillinov M, et al. Dexmedetomidine for reduction of atrial fibrillation and delirium after cardiac surgery (DECADE): a randomized placebo-controlled trial. *Lancet.* 2020;396:177-185.

Bottom line: Dexmedetomidine infusion did not decrease postoperative atrial arrhythmias or delirium in patients recovering from cardiac surgery.

Donnellan E, Jaber WA, et al. Prevalence, incidence, and impact on mortality of conduction system disease in transthyretin cardiac amyloidosis. *Am J Cardiol.* 2020;128:140-146.

Bottom line: The incidence and prevalence of high-grade atrioventricular block is high in patients with ATTR-CA, which calls for close monitoring for conduction system disease in this setting.

Lyden SP, et al. Mortality and paclitaxel-coated devices: An individual patient data meta-analysis. *Circulation.* 2020;141:1859-1869.

Bottom line: A meta-analysis using individual patient-level data revealed a smaller increased risk of mortality with paclitaxel-coated devices for peripheral artery disease than an initial aggregate-data meta-analysis from 2018.

Harb S, Jaber WA, et al. Prognostic value of functional capacity in different exercise protocols. *J Am Heart Assoc.* 2020;9:e01986.

Bottom line: Higher estimated metabolic equivalent (MET) values were reliably associated with reduced mortality in all seven exercise protocols studied, but prognostic value wasn't transferable across different protocols.

Starling RC, Soltesz EG, et al. Postimplant phosphodiesterase type 5 inhibitors use is associated with lower rates of thrombotic events after left ventricular assist device implantation. *J Am Heart Assoc.* 2020;9:e015897.

Bottom line: Postimplant use of PDE-5 inhibitors was associated with fewer thrombotic events and improved survival in LVAD recipients in this INTERMACS registry analysis.

Anter E, et al. Ablation of reentry-vulnerable zones determined by left ventricular activation from multiple directions: a novel approach for ventricular tachycardia ablation. A multicenter study (PHYSIO-VT). *Circ Arrhythm Electrophysiol.* Epub May 6, 2020.

Bottom line: In ablation of scar-related VT, mapping the heart during activation from multiple directions promises to improve clinical outcomes, this single-arm prospective trial suggests.

Wazni OM, Hussain AA, et al. Catheter ablation in patients with cardiogenic shock and refractory ventricular tachycardia. *Circ Arrhythm Electrophysiol.* 2020;13:e007669.

Bottom line: Bailout ablation for refractory ventricular arrhythmia in cardiogenic shock allowed successful weaning from mechanical support in a large percentage of patients in this 21-patient case series.

Kalra A, Kapadia SR, et al. Dual antiplatelet therapy after percutaneous coronary intervention and drug-eluting stents: a systematic review and network meta-analysis. *Circulation.* Epub Aug. 3, 2020.

Bottom line: Short-term dual antiplatelet therapy (DAPT) followed by P2Y12 inhibitor monotherapy appears to reduce major bleeding after PCI with drug-eluting stents relative to 12-month DAPT, while the latter reduces myocardial infarction at the expense of more bleeding.

*Space limitations allow listing of only some principal and/or senior Cleveland Clinic authors here. Check out the reference citation for full authorship of publications listed.

Cleveland Clinic

The Cleveland Clinic Foundation
9500 Euclid Ave./AC311
Cleveland, OH 44195

Cardiac Consult

20-HVI-1911100

Keep Current With Live Virtual CME from Cleveland Clinic

State-of-the-Art Echocardiography 2020

Sat., Oct. 3, 2020
Offered virtually via livestream (complimentary registration)

Information/registration:
ccfcme.org/echocardio20

Cardiovascular Update for the Primary Care Provider

Thu.-Fri., Oct. 15-16, 2020
Offered virtually via livestream (complimentary registration)

Information/registration:
ccfcme.org/cardioupdate20

The Unpartitioned AV Connection: 5th Annual Advances in Pediatric and Congenital Heart Summit

Fri.-Sat., Oct. 16-17, 2020
Offered virtually via livestream

Information/registration:
ccfcme.org/congenitalheart20

Cleveland Clinic Case Reviews in Cardiology

Sat.-Sun., Nov. 7-8, 2020
Offered virtually via livestream (complimentary registration)

Information/registration:
ccfcme.org/cvmcasereviews20

Mastering the Mitral Valve: A Case-Based Approach

Fri.-Sat., Dec. 4-5, 2020
Offered virtually via livestream (complimentary registration)

Information/registration:
ccfcme.org/mitralmasters
(see page 18 for more details)

Valve Disease, Structural Interventions and Diastology/Imaging Summit

Fri., Feb. 5, 2021
Offered virtually via livestream

Information/registration:
ccfcme.org/echo

These activities have been approved for *AMA PRA Category 1 Credit™*.

Cardiac Consult **Is Now a Podcast Too**

Listen at **clevelandclinic.org/cardiacconsultpodcast** or subscribe from your favorite podcast source.