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Clinical Outcomes & Recognition

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Meet Our Cardiac Surgeons

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Research & Innovations

- Reducing Operatives Times and Direct Hospital Costs with Right Mini-Thoracotomy Mitral Valve Repair
- Using Machine Learning to Predict Mitral Valve Surgery Outcomes
- Defining Carotid Access as the Optimal Alternative Access Approach for Transcatheter Aortic Valve Replacement
- Reducing Perioperative Bleeding for Coronary Artery Bypass Surgery with Appropriate Thienopyridine Discontinuation
- Using ERAS to reduce Racial and Ethnic Disparities Associated with Coronary Artery Bypass Grafting
- Expanding the Boundaries of Heart Transplantation
- Understanding Heart Transplant Outcomes of Patients on Biventricular Mechanical Support
- Defining ECMO use Post Cardiac Surgery



About Hartford HealthCare

With 36,000 colleagues, Hartford HealthCare's unified culture enhances access, affordability, equity and expertise. Its care delivery system — with more than 400 locations serving 185 towns and cities — includes two tertiary-level teaching hospitals, an acute-care community teaching hospital, an acute-care hospital and trauma center, three community hospitals, a behavioral health network, a multispecialty physician group, a clinical care organization, a regional home care system, an array of senior care services, a mobile neighborhood health program and a comprehensive physical therapy and rehabilitation network. On average, Hartford HealthCare touches more than 17,000 lives every single day. The unique, system-wide institute model offers a unified high standard of care in crucial specialties at hospital and ambulatory sites across Connecticut, providing unparalleled expertise at the most affordable cost. The institutes include: cancer, heart and vascular, digestive health, Ayer Neuroscience, orthopedics and Tallwood Urology.

Visit Hartford HealthCare at www.HartfordHealthCare.org and stay connected through newsletters and social media.



Heart & Vascular Institute

About the Hartford HealthCare Heart & Vascular Institute

The Hartford HealthCare Heart & Vascular Institute is a national leader in cardiovascular disease prevention, treatment and research, bringing together the expertise of more than 400 physicians and providers in 55 locations and seven acute care hospitals in Connecticut and southwestern Rhode Island. With a focus on innovation, cutting-edge technology, and clinical research, the Institute aims to deliver the highest quality cardiovascular care to patients. Its providers' expertise span every cardiovascular specialty including clinical cardiology, cardiac and cardiothoracic surgery, electrophysiology, advanced heart failure, interventional cardiology, structural heart diseases and vascular surgery. The Institute is home to many "firsts" in cardiac surgery in Connecticut, notably the first coronary artery bypass graft in 1968, the first successful heart transplant in 1984, and the first balloon-expandable transcatheter aortic valve replacements (TAVR) procedure in 2012. Additionally, the Institute has earned distinguished international three-star ratings from the Society of Thoracic Surgeons for its patient care and outcomes in aortic valve replacement, coronary artery bypass grafting, and mitral valve replacement and repair, which denote the highest possible achievement for any institution.

Our Values

Caring

We Do the Kind Thing

Every Hartford HealthCare colleague touches the lives of the patients and families in our care. We treat those we serve and each other with kindness and compassion and strive to better understand and respond to the needs of a diverse community.

Equity

We Do the Just Thing

We commit to the fair treatment, access, opportunity and advancement for all. We value the uniqueness of each person and embrace diverse backgrounds, opinions and experiences. We foster intellectual, racial, social and cultural diversity and treat everyone with dignity and respect. Our customers, patients and colleagues experience Hartford HealthCare's culture of belonging.

Excellence

We Do the Best Thing

In Hartford HealthCare, only the best will do. We work as a team to bring experience, advanced technology and best practices to bear in providing the highest-quality care for our patients and families. We devote ourselves to continuous improvement, excellence, professionalism and innovation in our work.

Integrity

We Do the Right Thing

Our actions tell the world what Hartford HealthCare is and what we stand for. We act ethically and responsibly in everything we do and hold ourselves accountable for our behavior. We bring respect, openness and honesty to our encounters with patients, families and coworkers and support the well-being of the communities we serve.

Safety

We Do the Safe Thing

Patients and families have placed their lives and health in our hands. At Hartford HealthCare our first priority, and the rule of medicine, is to protect them from harm. We believe that maintaining the highest safety standards is critical to delivering high-quality care and that a safe workplace protects us all.

Message from Jeffrey Flaks
Hartford HealthCare President & Chief Executive Officer

Dear Colleague,

Thank you for your interest in the Hartford HealthCare Heart & Vascular Institute’s Cardiac Surgery Clinical Outcomes & Innovation Report. In these pages, we are proud to share innovations and clinical breakthroughs; highlight our research and life-saving care; and provide data that supports the many national accolades our institute has earned.

Most important, though, is our unwavering commitment to making healthcare more accessible, affordable, equitable and excellent for everyone we are privileged to serve. Hartford HealthCare’s unique institute model of care makes it possible for us to keep these commitments to our communities.

Access: As a health system and as an institute, we are focused on improving access and eliminating inequities in how this life-saving care is delivered. Through our coordinated system of care, patients across Connecticut and south western Rhode Island have easy access to advanced cardiac surgical care through one of our 55 ambulatory locations and seven acute care facilities.

Affordability: Institute-wide efforts work to reduce post-operative complications, lower length of stay, reduce re-hospitalizations, enhance quality and lower overall cost of care. Through our commitment to community-based cardiology services — with direct access to the region’s top tertiary center for the most advanced care when needed — cardiac issues are detected, assessed and treated before they become more costly and severe. Hartford HealthCare continues to create and deliver more cost-effective and convenient care options, including our comprehensive ambulatory network.

Equity: Our multidisciplinary team is addressing disparities in clinical outcomes, and lowering morbidity and length of stay after procedures in historically underserved populations through innovation and collaboration.

Expertise: In 2022, our talented surgeons and support teams at Hartford Hospital and St. Vincent’s Medical Center alone performed nearly 2,300 surgical procedures while achieving patient outcomes that have exceeded the highest industry benchmarks in areas such as valve repair, valve replacement, coronary artery bypass grafting and transplant, just to name a few. This commitment to excellence has placed our cardiac surgical program among the most elite in the country.

Our vision is to be “most trusted for personalized coordinated care.” In this report, you will see how the Hartford HealthCare Heart & Vascular Institute’s team is bringing this vision to life through demonstrated patient outcomes, a fierce commitment to quality, safety and innovation, and ensuring that all of our patients receive the care they need where and when they need it most.

Thank you for reading. **You can learn more at HartfordHealthCare.org/heart.**



Jeffrey A. Flaks
President and Chief Executive Officer
Hartford HealthCare

Message from the Chairman

Dear Colleague,

I am proud to share with you the Hartford HealthCare Heart & Vascular Institute’s 2022 Clinical Outcomes and Innovations Report. In the following pages, you will see why our team’s fierce commitment to providing the highest quality care and inspiring innovation makes us one of the most elite cardiac surgery programs in the country.

Serving Hartford Hospital, St. Vincent’s Medical Center and patients throughout our seven-hospital health system and beyond, the program continues to be recognized nationally. In 2022, Hartford Hospital’s cardiac surgery team received the highest three-star rating from the Society of Thoracic Surgeons (STS) for its patient care and outcomes in coronary artery bypass grafting (CABG), mitral valve replacement/repair (MVRR), combined MVRR and CABG , transcatheter aortic valve replacement (TAVR), and combined aortic valve replacement (AVR) and CABG. Hartford Hospital was the only center in Connecticut to achieve a three-star rating in any category.

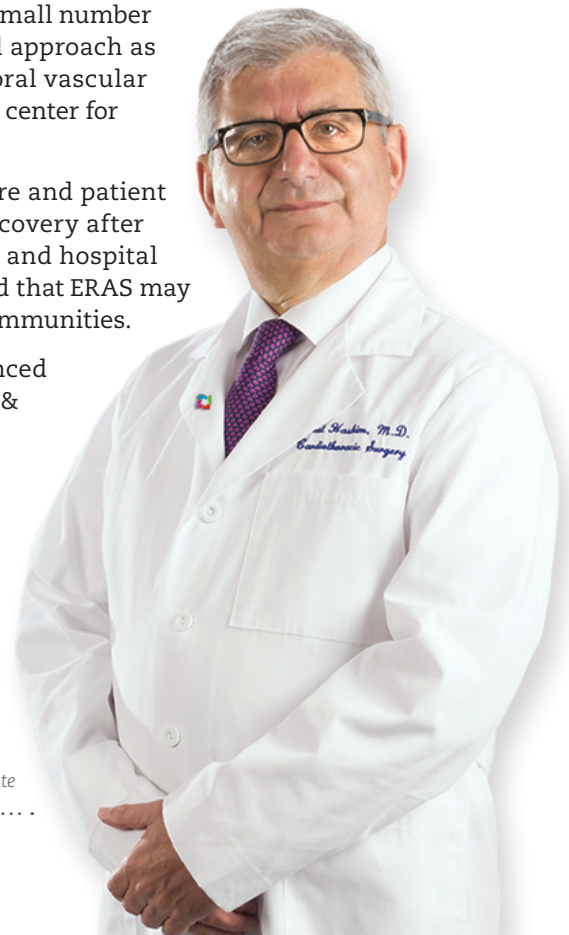
Hartford Hospital was also named one of America’s 50 Best Hospitals for Cardiac Surgery by Healthgrades and earned the Mitral Valve Repair Reference Center Award from the Mitral Valve Foundation and the American Heart Association for three years in a row. In 2021, the hospital was named The Joint Commission’s first Comprehensive Cardiac Center Certification in New England. And, our heart transplant program continues to exceed national one-year survival rates and has one of the highest organ acceptance rates, making Hartford Hospital one of the most progressive centers in the country.

In these pages, you will read about specific advances and innovation in cardiac surgery. In the field of mitral valve surgery, our investigators have shown that changes in operative technique can reduce hospital costs in patients undergoing minimally-invasive mitral valve repair versus those treated with a conventional sternotomy. In collaboration with the Massachusetts Institute of Technology, our investigators have used machine learning to develop a surgical risk model for mitral valve surgery that may be more accurate than the existing STS risk calculator for predicting mortality.

In the field of aortic valve replacement, Hartford Hospital has joined a small number of centers in the United States in pioneering the use of a transcarotid approach as the optimal surgical technique for TAVR patients requiring non-femoral vascular access. Hartford Hospital has been chosen as the first national training center for transcarotid TAVR in the United States.

You will also see how our team is working to address inequities in care and patient outcomes. Advances have focused on the efficacy of an Enhanced Recovery after Surgery (ERAS) clinical pathway in reducing postoperative morbidity and hospital length of stay. In partnership with anesthesiology, we have documented that ERAS may be a useful tool in reducing CABG results’ disparities in underserved communities.

In partnership with our cardiologists, cardiac anesthesiologists, advanced practitioners, perfusionists, and nurses, the Hartford HealthCare Heart & Vascular Surgery team continues to provide the highest quality care to our patients while helping to advance the field for years to come.



Sabet Hashim, MD
Chairman of Cardiac Surgery
Co-Physician-in-Chief
Hartford HealthCare Heart & Vascular Institute



Clinical Outcomes

Clinical Outcomes

The Hartford HealthCare Heart & Vascular Institute’s cardiac surgery team offers the most comprehensive and coordinated care for surgical patients in the region. Backed by expert cardiologists, cardiac anesthesiologists, advanced practitioners, perfusionists, and nurses, our surgeons perform more than 2,200 procedures each year at our two centers at Hartford Hospital and St. Vincent’s Medical Center in Bridgeport.

2022 Surgical Volumes for Hartford Hospital and St. Vincent’s Medical Center



Total Procedural Volume	1,973
Total Coronary Artery Bypass Grafting	689
Total Valve Volume	930
Surgical Aortic Valve Replacement	345
Transcatheter Aortic Valve Replacement	319
Mitral Valve Replacement	154
Mitral Valve Repair	137
Tricuspid Valve Replacement	10
Tricuspid Valve Repair	47
Atrial Septal Defect/PFO Closure	41
MAZE Procedure	135
Left Atrial Appendage Closure	169
Heart Transplants	27
ECMO	55
Long-Term Ventricular Assist Devices	6



Clinical Outcomes *(continued)*

**Hartford
HealthCare**
St. Vincent's Medical Center

Total Procedural Volume	280
Total Coronary Artery Bypass Grafting	160
Total Valve Volume	47
Surgical Aortic Valve Replacement	27
Transcatheter Aortic Valve Replacement	105
Mitral Valve Replacement	19
Mitral Valve Repair	15
Tricuspid Valve Replacement	2
Tricuspid Valve Repair	2
Atrial Septal Defect/PFO Closure	2
MAZE Procedure	13
Left Atrial Appendage Closure	7
ECMO	2



The background is a solid orange color with several large, semi-transparent geometric shapes. At the top, there are two large, rounded 'F' shapes. Below them, there are various patterns of dots and lines. A central vertical shape consists of horizontal lines. At the bottom, there are more 'F' shapes, some filled with diagonal lines and others with vertical lines. The text 'National Recognition' is centered in white, bold, sans-serif font.

National Recognition

Nationally Recognized for Quality

The Hartford HealthCare Heart & Vascular Institute is a national leader in cardiac surgery and is consistently rated among the best programs in the country for the quality of care we deliver.

Latest Quality Ranking by the Society of Thoracic Surgery

Twice a year, the Society of Thoracic Surgeons (STS) provides cardiac surgery performance ratings of hospitals in the United States. The rating applies to five categories, and Hartford Hospital has achieved the maximum “3 STAR” rating in four out of five categories for the latest 2021 and 2022 rankings. Achievement of the 3 STAR rating for any one of these categories places a hospital in the top performing 4-9% of all hospitals participating in the STS national database. By attaining the highest STS rankings in multiple surgical categories, Hartford Hospital is placed among the most elite cardiac surgery centers in the country.



	Coronary Artery Bypass		Aortic Valve Replacement with Coronary Artery Bypass		Mitral Valve Repair and Replacement		Mitral Valve Repair and Replacement with Coronary Artery Bypass	
	June	December	June	December	June	December	June	December
2021	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★
2022	★★★★	----	★★★★	----	★★★★	----	★★★★	----

Hartford HealthCare Heart & Vascular Institute at Hartford Hospital Named Among America's 50 Best for Cardiac Surgery

Hartford Hospital has been named one of America's 50 Best Hospitals for Cardiac Surgery according to new research released by Healthgrades, the leading resource that connects consumers, physicians and health systems.

Every year, Healthgrades evaluates hospital performance at nearly 4,500 hospitals nationwide for 32 of the most common inpatient procedures and conditions using Medicare data, and outcomes in appendectomy and bariatric surgery using all-payer data provided by 16 states.



U.S. News & World Report Rates Hartford Hospital Best in Hartford Metro Area

Hartford Hospital is rated as the No. 1 hospital in the Hartford Metro Area and among the best hospitals in Connecticut for 2022-23 by U.S. News & World Report. US News & World Report also ranks the hospital as "high performing" in both heart bypass surgery and aortic valve surgery.



HEART BYPASS SURGERY



AORTIC VALVE SURGERY

The Joint Commission's First Comprehensive Cardiac Center in New England

The Hartford HealthCare Heart & Vascular Institute at Hartford Hospital has earned The Joint Commission's Comprehensive Cardiac Center (CCC) Certification, becoming the first cardiac program in New England and one of 16 nationally to be awarded this prestigious designation.

Offered in collaboration with the American Heart Association, Comprehensive Cardiac Center Certification is the premier cardiovascular certification awarded to hospitals that demonstrate high-quality care using evidence-based, guidelines-driven treatment and foster collaboration throughout the system of care.

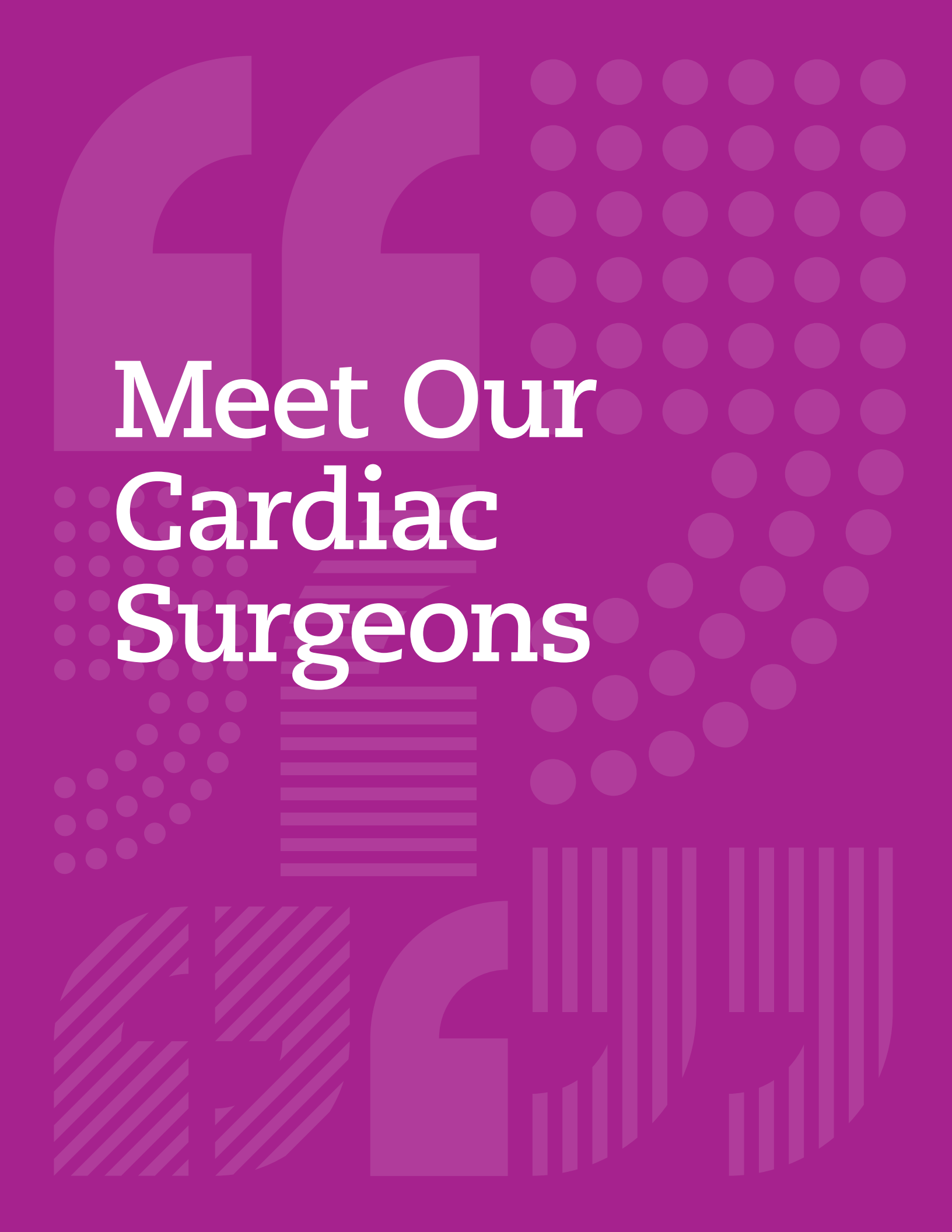


The Joint Commission



American Heart Association

CERTIFICATION
Meets standards for
Comprehensive Cardiac Center



Meet Our Cardiac Surgeons



Sabet Hashim, MD
 Chairman of Cardiac Surgery
 Co-Physician-in-Chief
 Hartford HealthCare Heart & Vascular Institute

Biography

Sabet Hashim, MD, is best known for his expertise in mitral valve repair. Before becoming chairman of cardiac surgery and co-physician-in-chief of the Hartford HealthCare Heart & Vascular Institute in 2016, Dr. Hashim was director of cardiac valve surgery for a decade at Yale New Haven Hospital. While there, he performed New England's first mitral valve repair in 1984. That same year, Dr. Hashim performed the first heart transplant in Connecticut.

Dr. Hashim developed one of the first mitral valve repair programs in the United States. He has pioneered techniques in minimally-invasive aortic and mitral valve surgery. Dr. Hashim has consistently maintained the largest mitral valve practice in Connecticut and has performed more than 2,000 mitral valve repairs and 10,000 open-heart procedures. He has served as a primary investigator on several trials, including SurTAVI, COAPT, Apollo and Commence.

Dr. Hashim has received numerous professional honors and awards, has presented his work at national and international forums and has published extensively in peer-reviewed journals.

Education

Internship

St. Luke's Hospital, NY

Medical School

St. Joseph's Jesuit University
 School of Medicine, Beirut

Residency

St. Luke's Hospital, NY
 Yale New Haven Hospital

Undergraduate

Lycée Francais of Beirut

Areas of Expertise

Aortic valve replacement, coronary artery bypass surgery, heart valve surgery, inherited cardiovascular diseases, mini invasive aortic and mitral surgery, mitra clip for mitral regurgitation, mitral valve repair, repair of ischemic mitral regurgitation, surgery for hypertrophic obstruction cardiomyopathy (HOCM), transcatheter mitral valve repair (TMVR).

Contact

Hartford Hospital

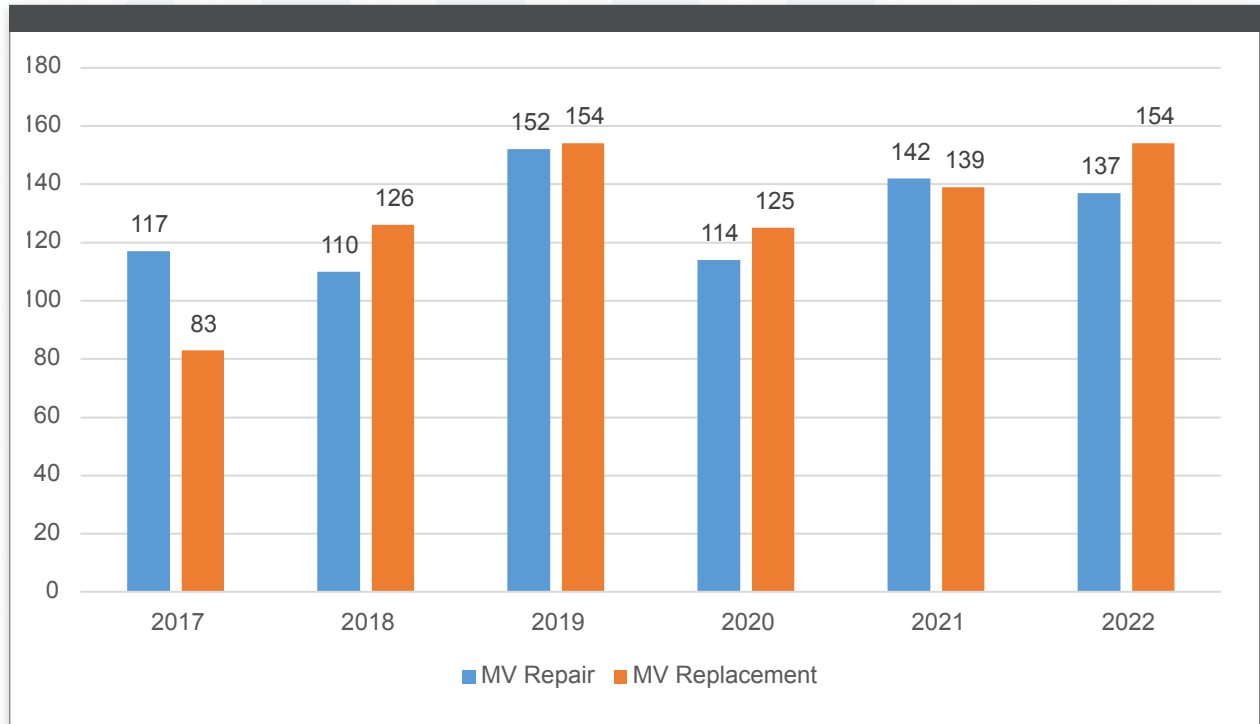
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 Hartford, CT 06106
 ph 860.696.5520
 fx 860.522.3951

St. Vincent's Medical Center

2800 Main Street
 Bridgeport, CT 06606
 ph 203.576.5708
 fx 203.367.8392

Volume and Quality of Mitral Valve Surgery at Hartford HealthCare

Under the leadership of Dr. Hashim, mitral valve repair and replacement have grown at Hartford HealthCare over the last five years.



As a testament to Hartford Hospital’s mitral valve repair outcomes, the hospital received the Mitral Valve Repair Reference Center Award from the American Heart Association in 2021 and 2022. This award identifies the nation’s best hospitals and surgeons for mitral valve repair surgery based on objective performance measures. This special recognition is achieved by demonstrating a record of superior clinical outcomes, as well as an ongoing commitment to reporting and measuring quality and performance metrics specific to mitral valve repair. Hartford Hospital was the 10th center recognized in the U.S. and the first in New England.



The STS Composite Quality Rankings for Mitral Valve Repair/Replacement and for Mitral Valve Repair/Replacement with Coronary Artery Bypass for the period ending December 2021

Mitral Valve Repair/Replacement:

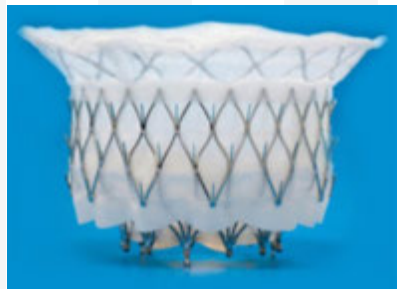
Domain	Rating	Participant		STS				
		Score	95% CI	Score	Min - Max	10th	50th	90th
Overall	★ ★ ★	97.11%	(96.18-97.90)	93.69%	(82.83-97.96)	90.81%	94.04%	96.11%
Absence of Mortality	★ ★ ★	98.62%	(97.71-99.29)	96.85%	(89.85-99.21)	95.09%	97.09%	98.29%
Absence of Morbidity	★ ★ ★	91.53%	(89.06-93.71)	85.85%	(70.03-94.30)	80.84%	86.27%	90.30%

Mitral Valve Repair/Replacement with Coronary Artery Bypass Grafting:

Domain	Rating	Participant		STS				
		Score	95% CI	Score	Min - Max	10th	50th	90th
Overall	★ ★ ★	90.71%	(87.88-93.12)	85.00%	(66.75-94.26)	79.31%	85.51%	89.98%
Absence of Mortality	★ ★ ★	95.96%	(93.32-97.91)	92.12%	(76.54-97.85)	87.97%	92.64%	95.57%
Absence of Morbidity	★ ★	78.37%	(72.68-83.52)	72.70%	(52.67-86.89)	65.31%	73.07%	79.61%

Current Participation in Research Trials

During the course of his career, Dr. Hashim has served as a principal investigator on multiple national and international research trials. In the past, he served as a primary investigator for the sentinel SurTAVI trial assessing the use of transcatheter aortic valve replacement in patients with intermediate surgical risk, as well as the landmark COAPT trial assessing the safety and efficacy of MitraClip mitral valve repair in patients with secondary mitral regurgitation. Currently, he is the co-primary investigator for the APOLLO Trial.



The Medtronic APOLLO Trial is designed to evaluate the safety and efficacy of the Intrepid Transcatheter Mitral Valve Replacement System for patients with symptomatic moderate-to-severe or severe mitral regurgitation who are unsuitable for traditional mitral valve surgery. This system integrates self-expanding stent technology with a tissue heart valve, pictured at left, to facilitate minimally-invasive, catheter-based implantation. The prosthesis is compressed inside a hollow delivery catheter and implantation is completed through trans-apical access. It is designed to engage and conform to the native annulus without need for additional sutures, tethers, or anchors.

2022 Peer-Reviewed Research Publications

1. Hashim SW, McMahon SR, Vaitkeviciute IK, Collazo S, Hashim IM, Loya DS, Takata ET, Mather JF, McKay RG. Propensity-matched comparison of right mini-thoracotomy versus median sternotomy for isolated mitral valve repair. *J Cardiovasc Surg (Torino)*. 2022 Dec;63(6):724-733.
2. Sutton TS, McKay RG, Mather J, Takata E, Eschert J, Cox M, Douglas A, McLaughlin T, Loya D, Mennett R, Cech MG, Hinchey J, Walker A, Hammond J, Hashim S. Enhanced Recovery After Surgery Is Associated With Improved Outcomes and Reduced Racial and Ethnic Disparities After Isolated Coronary Artery Bypass Surgery: A Retrospective Analysis With Propensity-Score Matching. *J Cardiothorac Vasc Anesth*. 2022;36(8 Pt A):2418-2431.
3. Ingrassia JJ, Mosleh W, Conner CM, Mather JF, Loya DS, Yaffee DW, Sutton TS, Takata ET, McMahon SR, Hashim SW, McKay RG. Impact of ticagrelor versus clopidogrel on bleeding outcomes of isolated coronary artery bypass grafting. *Cardiovasc Revasc Med*. 2022;S1553-8389(22)00700-X.
4. Orfanoudaki A, Giannoutsou A, Hashim S, Bertsimas D, Hagberg RC. Machine learning models for mitral valve replacement: A comparative analysis with the Society of Thoracic Surgeons risk score. *J Card Surg*. 2022;37(1):18-28.
5. Takata ET, Eschert J, Mather J, McLaughlin T, Hammond J, Hashim SW, McKay RG, Sutton TS. Enhanced Recovery After Surgery Is Associated With Reduced Hospital Length of Stay after Urgent or Emergency Isolated Coronary Artery Bypass Surgery at an Urban, Tertiary Care Teaching Hospital: An Interrupted Time Series Analysis With Propensity Score Matching. *J Cardiothorac Vasc Anesth*. 2023 Jan;37(1):31-41.



Robert C. Hagberg, MD
*Chief of Cardiac Surgery
 Hartford Hospital*

Biography

Robert C. Hagberg, MD, currently serves as the chief of cardiac surgery at Hartford Hospital. Dr. Hagberg received his undergraduate and medical degrees at Stanford University. Following medical school, he completed a residency at Massachusetts General Hospital and subsequently returned to Stanford to complete a cardiothoracic fellowship. Following his fellowship, he entered private practice in Norfolk, Va., where he acted as investigator for a number of device trials in cardiac and vascular surgery, including several valve and stent graft trials, which eventually led to FDA approval. He then went on to join the surgical staff at Beth Israel Deaconess Medical Center/Harvard Medical School in Boston, where he was an assistant professor of surgery. There, he taught the clinical practice of cardiac surgery to Harvard medical students and general surgical residents, as well as cardiothoracic surgical residents and fellows.

Dr. Hagberg is a nationally renowned surgeon, researcher and educator who has elevated Hartford Hospital's cardiac surgery program, contributed to cardiac surgery research, expanded cardiac surgical procedures and helped train the next generation of advanced heart surgeons.

Education

Internship

Stanford University School of Medicine

Graduate School

Stanford University

Medical School

Stanford University School of Medicine

Residency

Massachusetts General Hospital

Undergraduate

Stanford University

Areas of Expertise

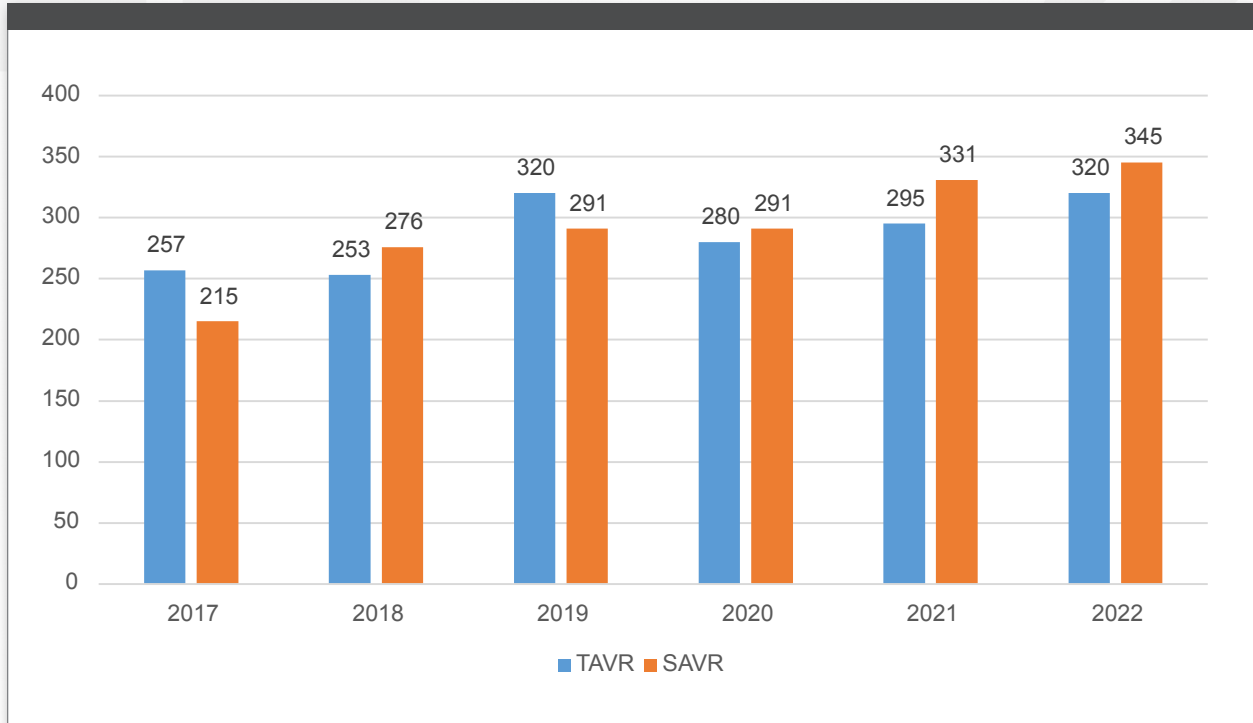
Acute pulmonary emboli, adult congenital heart disease, aortic valve replacement, coronary artery bypass surgery, endovascular treatment of thoracic aortic disease, heart valve surgery, inherited cardiovascular diseases, maze and mini maze for atrial fibrillation, mechanical circulatory support, mini invasive aortic and mitral surgery, mitral valve repair, open thoracic aortic surgery, open thoracoabdominal aortic surgery, repair of ischemic mitral regurgitation, transcatheter aortic valve replacement (TAVR), transcatheter mitral valve repair (TMVR).

Contact


Hartford Hospital

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Volume and Quality of Aortic Valve Replacement at Hartford Hospital





Hartford Hospital's latest 3-Star TAVR rating from the STS/ACC TVT Registry:

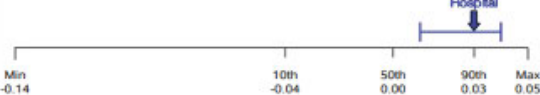


STS/ACC TVT Registry
Public Reporting Metrics

Patients with TAVR as of 2021 q3
Hospital 423549



Timeframe First TAVR Procedure Performed	My Hospital TAVR Volume* (commercial procedures only)		Distribution of Annual Hospital TAVR Volumes (Across all TVT Registry Hospitals)
	Cumulative	Annual volume (Oct 1, 2020 - Sep 30, 2021)	
Feb, 2012	1669	293	

My Hospital TAVR 30 Day Composite Site Difference ^{1,2,3} (95% Confidence Interval)	Eligible Patients (Oct 1, 2018 - Sep 30, 2021)	Participant Rating	Distribution of Participant Estimates
0.03 (0.01 to 0.04)	850	★★★	

¹ Missing value (-) indicates that hospital does not meet eligibility criteria for reporting.

² 30 Day Composite consists of six ordered categories based on the worst possible outcome (30-day death) to the best possible outcome (e.g. alive and free of major complications) during hospitalization and the 30-day follow-up period as defined below:

1. 30-day death
2. 30-day stroke
3. 30-day life-threatening or major bleeding
4. Acute kidney injury (stage III)
5. 30-day moderate to severe paravalvular aortic regurgitation (PVL)
6. None of the above

Current Participation in Research Trials:

Dr. Hagberg has served as the surgical primary co-investigator on multiple TAVR trials leading to the FDA approval of TAVR in high-intermediate- and low-risk patients, including the Cor Valve Pivotal Trial, SurTAVI Trial, Edwards Low Risk Trial, and the Edwards Low Risk Expanded Access. He also serves as the primary investigator for the OnX valve. OnX Registry, Terminate AF, PROACT Xa, and PEROGON Trial, as well as a co-investigator for the APOLLO Trial. His current research trials include the Evolut EXPAND TAVR II Pivotal Trial and the ALLIANCE Trial.

The Medtronic Evolut EXPAND TAVR II Pivotal Trial is designed to assess the use of the self-expanding, supra-annular Evolut valve TAVR in patients with symptomatic moderate aortic stenosis. This multicenter, international trial is the first randomized to evaluate patients with moderate aortic stenosis, a population currently not included in current AHA/ACC guidelines. Approximately 650 subjects will be enrolled worldwide.

The Edward's LifeSciences ALLIANCE trial is a prospective, single-arm, multicenter study designed to assess the safety and efficacy of a fourth-generation balloon expandable valve, the SAPIEN X4 Transcatheter Heart Valve, in patients with severe symptomatic aortic stenosis. The SAPIEN X4 Transcatheter Heart Valve system incorporates RESILIA tissue, a bovine pericardial tissue that incorporates a novel preservation technology which permanently blocks residual aldehyde groups known to bind calcium and preserves tissue with glycerol. This new X4 THV system design also includes adjustable valve sizing and radiopaque markers for commissure alignment. The Sapien X4 valve is expected to provide clinically significant improvements in hemodynamic, functional and quality of life outcomes with acceptable complication rates. Approximately 800 patients will be enrolled in this study across 65 sites and followed for approximately 10 years.

Recent Peer-Reviewed Publications

1. Orfanoudaki A, Giannoutsou A, Hashim S, Bertsimas D, Hagberg RC. Machine learning models for mitral valve replacement: A comparative analysis with the Society of Thoracic Surgeons risk score. *J Card Surg.* 2022 Jan;37(1):18-28.
2. Hoover NE, Ouranos HB, Memon S, Azemi T, Piccirillo BJ, Sadiq IR, Rizvi AA, Haider JM, Hagberg RC, Mather JF, Underhill DJ, McKay RG, Cheema M. Transcarotid Versus Transfemoral Transcatheter Aortic Valve Replacement (from a Propensity-Matched Comparison). *Am J Cardiol.* 2022 Dec 15;185:71-79.
3. Puskas JD, Gerdisch M, Nichols D, Fermin L, Rhenman B, Kapoor D, Copeland J, Quinn R, Hughes GC, Azar H, McGrath M, Wait M, Kong B, Martin T, Douville EC, Meyer S, Ye J, Jamieson WRE, Landvater L, Hagberg R, Trotter T, Armitage J, Askew J, Accola K, Levy P, Duncan D, Yanagawa B, Ely J, Graeve A; PROACT Investigators. Anticoagulation and Antiplatelet Strategies After On-X Mechanical Aortic Valve Replacement. *J Am Coll Cardiol.* 2018 Jun 19;71(24):2717-2726.
4. Gleason TG, Schindler JT, Hagberg RC, Deeb GM, Adams DH, Conte JV, Zorn GL 3rd, Hughes GC, Guo J, Popma JJ, Reardon MJ. Subclavian/Axillary Access for Self-Expanding Transcatheter Aortic Valve Replacement Renders Equivalent Outcomes as Transfemoral. *Ann Thorac Surg.* 2018 Feb;105(2):477-483.



Mohiuddin Cheema, MD
Cardiac Surgeon

Biography

Mohiuddin Cheema, MD, received his medical degree from Aga Khan University Medical College in Sindh, Pakistan, in 1998. He completed his internship and residency in general surgery at the University of Connecticut in 2005, followed by a vascular surgery fellowship at Albany Medical Center between 2005 and 2007. He joined Hartford Hospital as a vascular surgeon in 2007 and served as the director of endovascular services, director of the Noninvasive Vascular Lab, and site director for the vascular surgery fellowship. Between 2013 and 2015, he completed a cardiothoracic surgery fellowship at Cedars Sinai Medical Center before returning to Hartford.

Education

Fellowship

Albany Medical Center
Cedars Sinai Medical Center

Internship

University of Connecticut

Medical School

Aga Khan University

Residency

University of Connecticut

Undergraduate

Cadet College Hasan-Abdal

Areas of Expertise

Acute pulmonary emboli, central and peripheral venous interventions and reconstructions, coronary artery bypass surgery, endovascular treatment of abdominal aortic disease, endovascular treatment of thoracic aortic disease, extra corporeal membrane oxygenation, heart transplantation, inherited cardiovascular diseases, maze and mini maze for atrial fibrillation, open abdominal aortic surgery, open thoracic aortic surgery, peripheral vascular surgery, transcatheter aortic valve replacement (TAVR), transcatheter mitral valve repair (TMVR).

Contact

Hartford Hospital

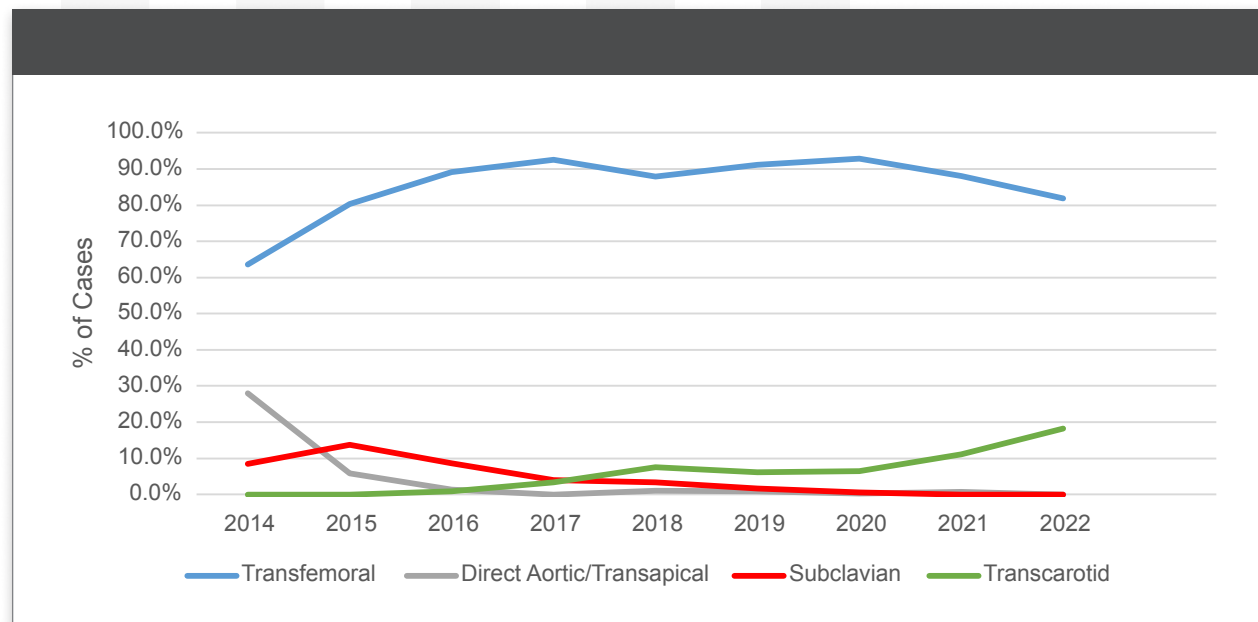
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Current Participation in Research Trials:

Board certified in both vascular and cardiothoracic surgery, Dr. Cheema has served as the primary investigator on multiple research trials involving both disciplines during his career. His current studies include the Tiomphe trial, Relay Pro-D, and Persevere. Notably, Dr. Cheema enrolled the first patient in the United States in the Persevere trial, a prospective, multicenter, non-randomized clinical trial consisting of approximately 100 participants in the U.S., who have experienced an acute DeBakey Type I aortic dissection. The trial is designed to assess the safety and efficacy of the AMDS aortic arch remodeling device. The design of the AMDS allows for rapid deployment of the graft in the aortic arch during a standard replacement of the ascending aorta, adding less than five minutes to the procedure time. The deployment of the AMDS preserves the native arch, potentially allowing for minimally-invasive re-interventions, including the repair of additional entry tears, rather than an invasive arch repair. Each participant will be followed for up to five years. The combined primary efficacy and safety endpoints will determine the impact of the AMDS Hybrid Prosthesis on reducing mortality, new disabling stroke, myocardial infarction, and new onset renal failure requiring dialysis, and also re-expansion of the true lumen of the aorta.

Pioneering the Optimal Alternative Access Route for TAVR

Following the initial FDA approval of TAVR use in 2011, Hartford Hospital initiated its TAVR program in 2012. Over the last 10 years, structural heart physicians have performed more than 2,500 TAVR procedures in extreme-risk, high-risk and intermediate-risk AS patients. Successful valve replacement has been performed with both balloon-expandable and self-expanding bioprotheses utilizing transfemoral, subclavian, carotid, direct aortic and transapical approaches. Under the leadership of Dr. Cheema, Hartford physicians have pioneered routine use of the transcatheter approach as the most commonly used alternative access technique.



Hartford Hospital Named National Training Destination for Carotid Approach to TAVR

Based upon the work of Dr. Cheema, Hartford Hospital has been selected as the first national training center for the carotid TAVR approach. Partnering with Edwards Lifesciences, physicians from across the country are currently being trained at the Hartford HealthCare Center for Education, Simulation and Innovation (CESI).

2020-2022 Carotid TAVR Publications

1. Allen KB, Chhatrwalla AK, Saxon J, Hermiller J, Heimansohn D, Moainie S, McKay RG, Cheema M, Jones B, Hodson RW, Korngold E, Kirker E. Transcarotid versus transthoracic access for transcatheter aortic valve replacement: A propensity-matched analysis. *J Thorac Cardiovasc Surg.* 2020 Oct 21:S0022-5223(20)32831-2.
2. Allen KB, Chhatrwalla AK, Saxon J, Hermiller J, Heimansohn D, Moainie S, McKay RG, Cheema M, Jones B, Hodson RW, Korngold E, Kirker E. Reply: Transcarotid trumps transapical/direct aortic access for transcatheter aortic valve replacement-It's a no brainer! *J Thorac Cardiovasc Surg.* 2021 Feb 22:S0022-5223(21)00129-X.
3. Amer MR, Mosleh W, Joshi S, Mather JF, El-Mallah W, Cheema M, McKay RG. Comparative Outcomes of Transcarotid and Transsubclavian Transcatheter Aortic Valve Replacement. *Ann Thorac Surg.* 2020 Jan;109(1):49-56.
4. Kirker E, Korngold E, Hodson RW, Jones BM, McKay R, Cheema M, Heimansohn D, Moainie S, Hermiller J, Chatriwalla A, Saxon J, Allen KB. Transcarotid Versus Subclavian/Axillary Access for Transcatheter Aortic Valve Replacement With SAPIEN 3. *Ann Thorac Surg.* 2020 Dec;110(6):1892-1897.
5. Hoover N, Ouranos H, Memon S, Azemi T, Piccirillo B, Sadiq I, Rizvi A, Haider J, Hagberg R, Mather J, Underhill D, McKay RG, Cheema M. Transcarotid Versus Transfemoral Transcatheter Aortic Valve Replacement: A Propensity-Matched Comparison. *Am J Cardiol* 2022 Dec 15;185:71-79.



Ayyaz A. Ali, MD, PhD

Vice Chairman of Cardiac Surgery

Surgical Director of Heart Transplantation and Mechanical Circulatory Support

Biography

Ayyaz Ali, MD, is an internationally known cardiothoracic and transplant surgeon who joined Hartford Hospital in 2019. He received his MD ChB degree from the University of Leicester in 1998, his MRCS degree in surgery from the Royal College of Surgeons in 2001, and a PhD in transplantation from the University of Leicester in 2010. He was originally a consultant cardiac and transplant surgeon at Papworth Hospital in Cambridge, UK, where he performed the largest number of cardiopulmonary transplant operations of any individual surgeon in the United Kingdom. In 2018, he became the surgical director of heart transplantation and mechanical circulatory support at Yale New Haven Hospital where he led a dramatic increase in the number of heart transplantations.

During the course of his career, Dr. Ali has performed more than 600 transplant operations, including heart transplant, single and double lung transplantation, and combined heart-lung transplantation. He is also skilled in the establishment of mechanical circulatory support for patients with severe heart failure having performed more than 91 implantations of temporary and durable ventricular assist devices.

Dr. Ali has had an extensive career in research, having served as cardiovascular research fellow at Stanford University from 2007 to 2009 and an associate research scientist at Columbia University from 2013 to present. He undertook basic science research at Stanford University and the University of Manitoba, forming the foundation of the clinical establishment of heart transplantation using Donation after Circulatory Death (DCD) donors. Supported by peer-reviewed grants, he helped develop an animal model of DCD donor heart resuscitation, and subsequently demonstrated that the heart can be resuscitated following circulatory arrest with good functional recovery. He helped further develop a model of porcine orthotopic heart transplantation in collaboration with the University of Manitoba, confirming that hearts resuscitated from DCD donors could be transplanted into the orthotopic position in a recipient animal with good circulatory support. His investigations led to development of a clinical program of DCD heart transplantation at Papworth Hospital, which quickly became the largest program in the world. DCD cardiac transplantation is now well established throughout the world with more than 400 of these procedures performed in the U.S. It is expected that 30-40% of all heart transplant procedures in the future will utilize a DCD donor heart. The research performed by Dr. Ali and his team was the foundation for this landmark achievement in cardiac transplantation.

Dr. Ali is the recipient of multiple research grants and research awards. He has extensively published in peer-reviewed journals with more than 65 manuscripts.

Education

Fellowship

University of Pittsburgh
Medical Center

Duke University Medical Center

Graduate School

Leicester University

Medical School

Leicester University Medical
School

Residency

Papworth Hospital
Cambridge, UK

Areas of Expertise

Aortic surgery, coronary artery bypass surgery, heart transplantation, lung transplantation, mechanical circulatory support, valvular heart disease.

Contact

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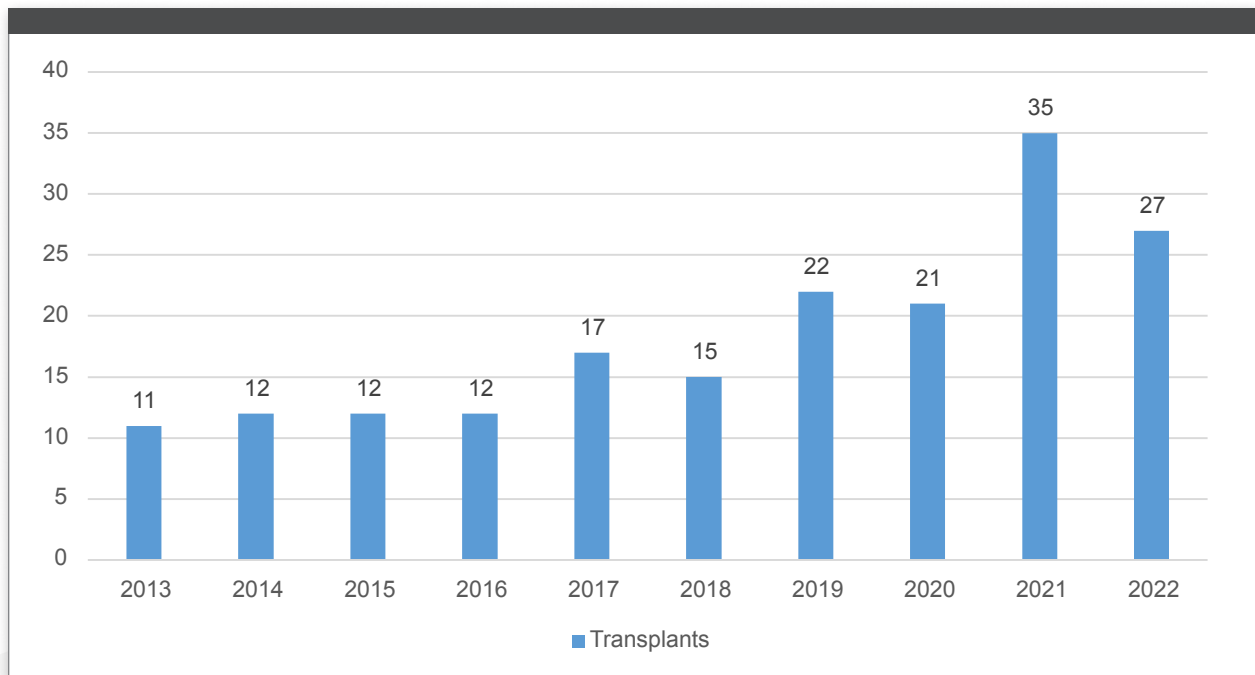
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Volume and Quality of Heart Transplant at Hartford Hospital

Under the leadership of Drs. Jonathan Hammond and Ali, the 10-year heart transplant volume at Hartford Hospital is illustrated below.



The latest report released by the Scientific Registry of Transplant Recipients in January 2021 highlights the Hartford Hospital heart transplant program's performance, reporting key clinical outcomes. This report found Hartford Hospital's one-year survival rate after heart transplantation to be 94.7%, which far exceeds the U.S. national average of 91.6%. Additionally, the report documented that the hospital's organ acceptance ratio is 2.38 — one of the highest in the U.S. — identifying Hartford Hospital as one of the most progressive programs in the country with regards to accepting organs offered to it for heart transplantation. The organ acceptance ratio is based on the observed-versus-expected acceptances when a donor heart is offered to patients who are wait-listed at a specific transplant center. Accordingly, Hartford Hospital's ratio of heart transplants performed compared to patients added to the waiting list in 2020 was 1.2, the highest in the U.S. This exemplifies the program's efficiency and ability to deliver heart transplantation to those patients who are added to its waiting list, demonstrating the Institute's commitment to increasing access to heart transplantation to those patients who suffer from advanced heart failure.

2021-22 Transplant Peer-Peer Reviewed Publications

1. Baran DA, Jaiswal A, Hennig F, Potapov E. Temporary mechanical circulatory support: Devices, outcomes, and future directions. *J Heart Lung Transplant*. 2022 Jun;41(6):678-691.
2. Jaiswal A, Baran D, Siphurmsukskul S, Baker WL. Cardiac donors with renal impairment: Usage and outcomes after heart transplant. *Clin Transplant*. 2022 Jul 5:e14767.
3. Jaiswal A, Gadela NV, Baran DA, Dasgupta O, Gluck J, Radojevic J, Arora S, Scatola A, Ali A, Hammond J, Jennings DL, Baker WL. Post Heart Transplantation Outcomes of Patients Supported on Biventricular Mechanical Support. *ASAIO J*. 2022 Jul 1;68(7):914-919.
4. Jaiswal A, Gadela NV, Baran D, Balakumaran K, Scatola A, Radojevic J, Gluck J, Arora S, Hammond J, Ali A, Jennings DL, Baker WL. Clinical outcomes of older adults listed for heart transplantation in the United States. *J Am Geriatr Soc*. 2021 Sep;69(9):2507-2517.
5. Jaiswal A, Gadela NV, Baran DA, Dasgupta O, Gluck J, Radojevic J, Arora S, Scatola A, Ali A, Hammond J, Jennings DL, Baker WL. Post Heart Transplantation Outcomes of Patients Supported on Biventricular Mechanical Support. *ASAIO J*. 2022 Jul 1;68(7):914-919.



Jonathan A. Hammond, MD
Cardiac Surgeon

Biography

Jonathan Hammond, MD, graduated magna cum laude with a bachelor of arts degree in 1980 from Williams College, and then went on to receive his MD degree from Harvard Medical School in 1984. Following a residency in general surgery at Hartford Hospital/University of Connecticut between 1984 and 1989 and a Cardiothoracic Surgery residency at the Medical College of Wisconsin between 1989 and 1991, he joined the staff at Hartford Hospital. In the past, he has served as surgical director for the mechanical circulatory support program, the surgical director of the cardiac transplant program, and director of the Division of Cardiovascular Surgery.

Education

Fellowship

Medical College of Wisconsin

Internship

Hartford Hospital/University of Connecticut Integrated Surgical Residency Program

Medical School

Harvard

Residency

Hartford Hospital/University of Connecticut Integrated Surgical Residency Program

Undergraduate

Williams College

Areas of Expertise

Acute pulmonary embolism, coronary artery bypass surgery, extra corporeal membrane oxygenation, heart transplantation, heart valve surgery, maze and mini maze for atrial fibrillation, mechanical circulatory support, open thoracic aortic surgery, pacemakers.

Contact

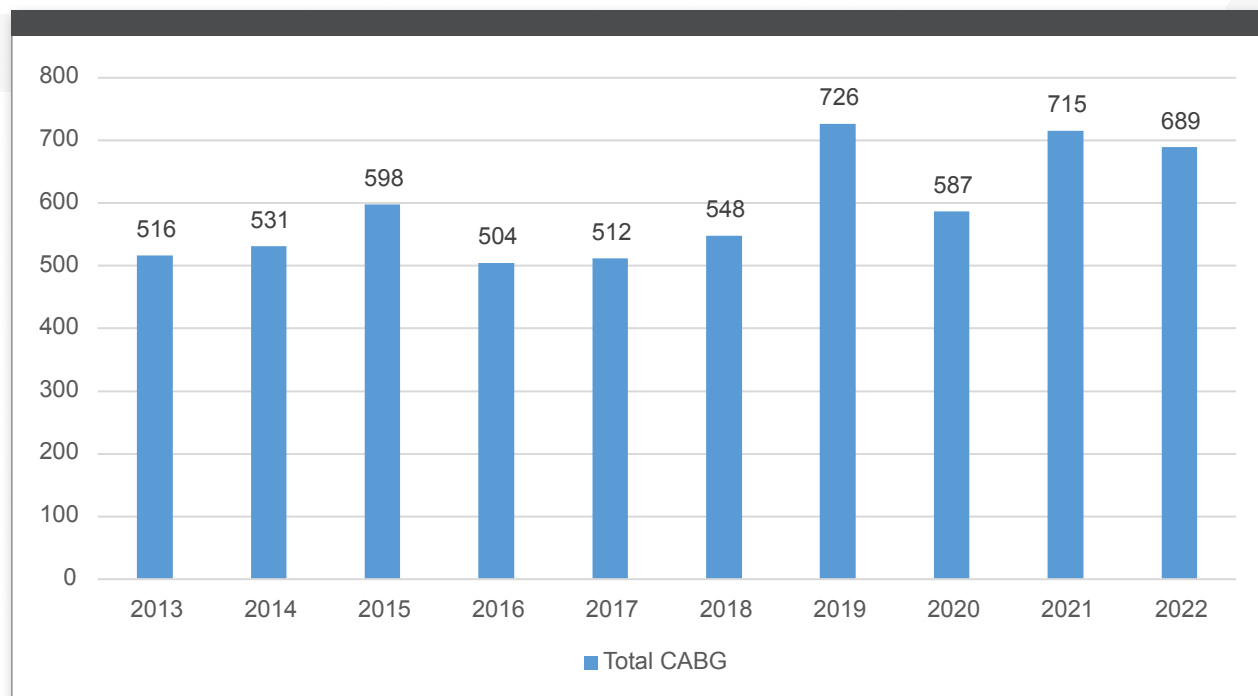
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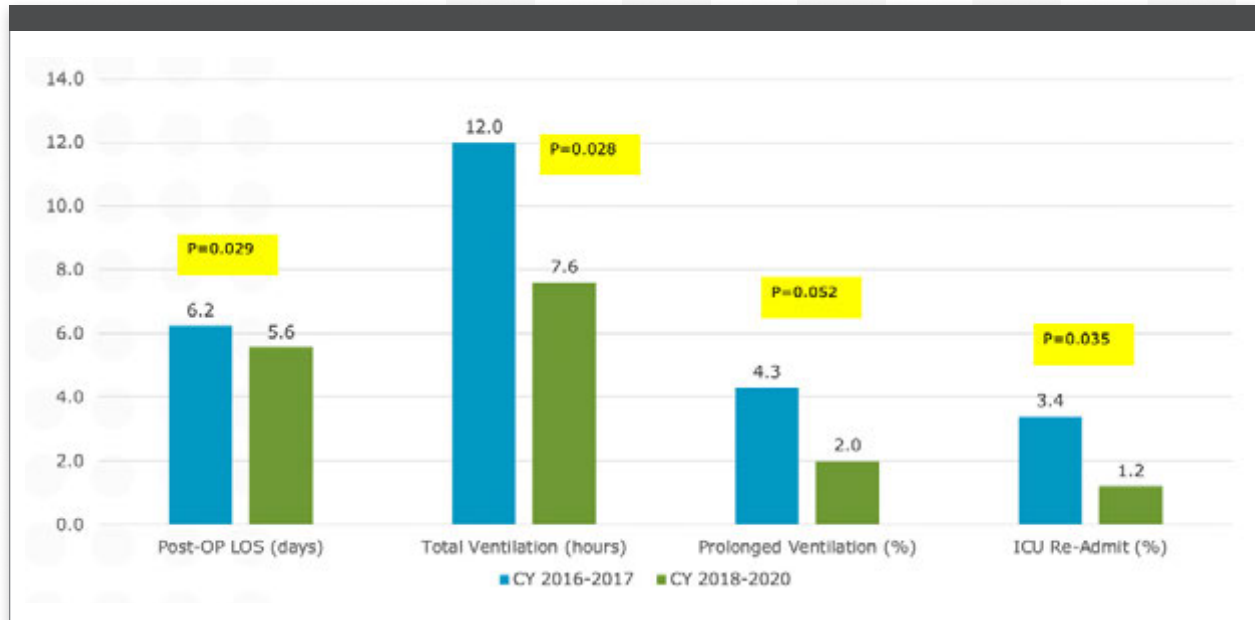
Time Course and Outcomes of ERAS Implementation for Cardiac Surgery

Enhanced Recovery After Surgery (ERAS) is a multidisciplinary approach to the care of surgical patients that has been demonstrated to reduce postoperative morbidity, improve postoperative recovery, and reduce overall costs associated with surgical care. Originally introduced in 1997, ERAS protocols currently exist in many surgical specialties and consensus guidelines for ERAS in cardiac surgery were published in 2019. In 2018 under the leadership of Drs. Hammond and Hashim, a Hartford Hospital institutional cardiac surgery ERAS clinical pathway was constructed by a multi-disciplinary team of cardiac anesthesiologists, cardiac surgeons, cardiac surgery intensivists, perioperative nurses, respiratory therapists, pharmacists, blood bank experts, and physical therapists. Following review of previously published ERAS guidelines, best practice policies were instituted to achieve perioperative ERAS goals regarding pre-habilitation, smoking and hazardous alcohol cessation, avoidance of preoperative dehydration, carbohydrate loading, perioperative goal-directed fluid therapy, multi-modal non-opioid analgesia, glycemic control, medication use (e.g., antibiotics, beta blockers, statins, aspirin), intraoperative anesthetic use, avoidance of persistent postoperative hypothermia, maintenance of chest tube patency, early postoperative enteral feeding and mobilization, and transitional planning. During the course of the 6-month ERAS rollout, specific strategies to promote early extubation, decreased ICU and hospital LOS, and decreased likelihood of re-intubation and ICU readmission were also implemented.

To-date, the beneficial impact of ERAS has been documented primarily in patients undergoing coronary artery bypass grafting.



Following implementation of ERAS, there have been significant reductions in postoperative length of stay, total ventilation hours and need for ICU readmission.



2022 ERAS Publications

1. Sutton TS, McKay RG, Mather J, Takata E, Eschert J, Cox M, Douglas A, McLaughlin T, Loya D, Mennett R, Cech MG, Hinchey J, Walker A, Hammond J, Hashim S. Enhanced Recovery After Surgery Is Associated With Improved Outcomes and Reduced Racial and Ethnic Disparities After Isolated Coronary Artery Bypass Surgery: A Retrospective Analysis With Propensity-Score Matching. *J Cardiothorac Vasc Anesth.* 2022;36(8 Pt A):2418-2431
2. Takata ET, Eschert J, Mather J, McLaughlin T, Hammond J, Hashim SW, McKay RG, Sutton TS. Enhanced Recovery After Surgery Is Associated With Reduced Hospital Length of Stay after Urgent or Emergency Isolated Coronary Artery Bypass Surgery at an Urban, Tertiary Care Teaching Hospital: An Interrupted Time Series Analysis With Propensity Score Matching. *J Cardiothorac Vasc Anesth.* 2023 Jan;37(1):31-41.



David Yaffee, MD
Cardiac Surgeon

Biography

David Yaffee, MD, graduated summa cum laude in 2004 with bachelor of arts and master of arts degrees in chemistry. He received his MD degree from New York University School of Medicine in 2008, where he also completed his general surgery residency in 2015 and cardiothoracic surgery residency in 2017. Throughout his training, Dr. Yaffee has had a dedicated interest in clinical research, serving as a post-doctoral research fellow in the Department of Cardiac Surgery at New York University School of Medicine between 2011 and 2013. He is extensively published in peer-reviewed journals.

Education

Fellowship

New York University School of Medicine

Graduate School

Boston University

Internship

New York University School of Medicine

Medical School

New York University School of Medicine

Residency

New York University School of Medicine

Undergraduate

Boston University

Areas of Expertise

Mitral valve repair, surgical treatment of hypertrophic cardiomyopathy, heart valve surgery, aortic surgery, surgical treatment of atrial fibrillation, coronary artery bypass surgery, extra corporeal membrane oxygenation (ECMO), inherited cardiovascular diseases, minimally-invasive surgery, robotic heart surgery, transcatheter aortic valve replacement (TAVR), transcatheter mitral valve repair (TMVR).

Established a Center of Excellence for Treating Hypertrophic Cardiomyopathy:

Hypertrophic cardiomyopathy (HCM) is a diverse disease resulting in left ventricular muscle hypertrophy and derangements in the mitral valve and the mitral subvalvular apparatus. Symptoms are the result of dynamic left ventricular outflow tract obstruction and may be debilitating. Due to the wide range of disease phenotypes, surgical treatment of HCM is often complex, and must be tailored to each individual patient to prevent the high failure rates seen at centers without specific HCM surgical expertise.

Having trained with one of the world's expert, Dr. Yaffee specializes in the surgical treatment of HCM. He is currently collaborating with Adaya Weissler-Snir, MD, a nationally known medical HCM specialist, to develop a regional center of excellence at Hartford Hospital for the multimodal treatment of HCM. Dr. Yaffee has also partnered with Dr. Hashim on specific patients who require concomitant complex mitral valve repair in addition to extended septal myectomy for the treatment of their HCM.

Contact

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Recent Research Publications

1. Ingrassia JJ, Mosleh W, Conner CM, Mather JF, Loya DS, Yaffee DW, Sutton TS, Takata ET, McMahon SR, Hashim SW, McKay RG. Impact of ticagrelor versus clopidogrel on bleeding outcomes of isolated coronary artery bypass grafting. *Cardiovasc Revasc Med.* 2022 Aug 6:S1553-8389(22)00700-X.
2. Yaffee DW, Williams MR. Cardiovascular Surgery in the Elderly. *Semin Thorac Cardiovasc Surg.* 2016 Winter;28(4):741-747. doi: 10.1053/j.semtcvs.2016.08.007. Epub 2016 Aug 24. PMID: 28417859.
3. Yaffee DW, Williams MR, Grossi EA. Rethinking the gold standard of correction for paravalvular leak: Why correct when you can prevent? *J Thorac Cardiovasc Surg.* 2016 Nov;152(5):e103-e104. doi: 10.1016/j.jtcvs.2016.07.057. Epub 2016 Aug 5. PMID: 27663523.
4. Ward AF, Applebaum RM, Toyoda N, Fakiha A, Neuburger PJ, Ngai J, Nampiaparampil RG, Yaffee DW, Loulmet DF, Grossi EA. Totally Endoscopic Robotic Left Atrial Appendage Closure Demonstrates High Success Rate. *Innovations (Phila).* 2017 Jan/Feb;12(1):46-49. doi: 10.1097/IMI.0000000000000330. PMID: 28129320.
5. Yaffee DW, Loulmet DF, Fakiha AG, Grossi EA. Fluorescence-guided placement of an endoaortic balloon occlusion device for totally endoscopic robotic mitral valve repair. *J Thorac Cardiovasc Surg.* 2015 May;149(5):1456-8. doi: 10.1016/j.jtcvs.2015.01.005. Epub 2015 Jan 9. PMID: 25641437.
6. Yaffee DW, DeAnda A, Ngai JY, Ursomanno PA, Rabinovich AE, Ward AF, Galloway AC, Grossi EA. Blood conservation strategies can be applied safely to high-risk complex aortic surgery. *J Cardiothorac Vasc Anesth.* 2015;29(3):703-9. doi: 10.1053/j.jvca.2014.10.022. Epub 2015 Apr 4. PMID: 25847415.



David Underhill, MD
Cardiac Surgeon

Biography

David Underhill, MD, graduated magna cum laude with a bachelor of arts in biology from Providence College in 1976 before receiving his MD from the University of Vermont Medical School in 1980. He went on to perform his general surgery internship and residency at Tufts New England Medical Center between 1980 and 1987, including serving as a cardiac surgery research fellow at the National Heart-Lung Blood Institute between 1983 and 1985, and chief general surgery resident at Tufts between 1986 and 1987.

He completed his training in thoracic surgery at the University of Michigan in 1989 before joining the staff at Hartford Hospital in 1992.

Education

Fellowship

National Institutes of Health
University of Michigan Health System

Internship

Tufts-New England Medical Center

Medical School

University of Vermont

Residency

Tufts-New England Medical Center

Undergraduate

Providence College

Areas of Expertise

Acute pulmonary embolism, coronary artery bypass surgery, endovascular treatment of abdominal aortic disease, endovascular treatment of thoracic aortic disease, extra corporeal membrane oxygenation, heart transplantation, heart valve surgery, lung surgery, maze and mini maze for atrial fibrillation, mechanical circulatory support, open abdominal aortic surgery, pacemakers, peripheral vascular surgery, transcatheter aortic valve replacement (TAVR), transcatheter mitral valve repair (TMVR).

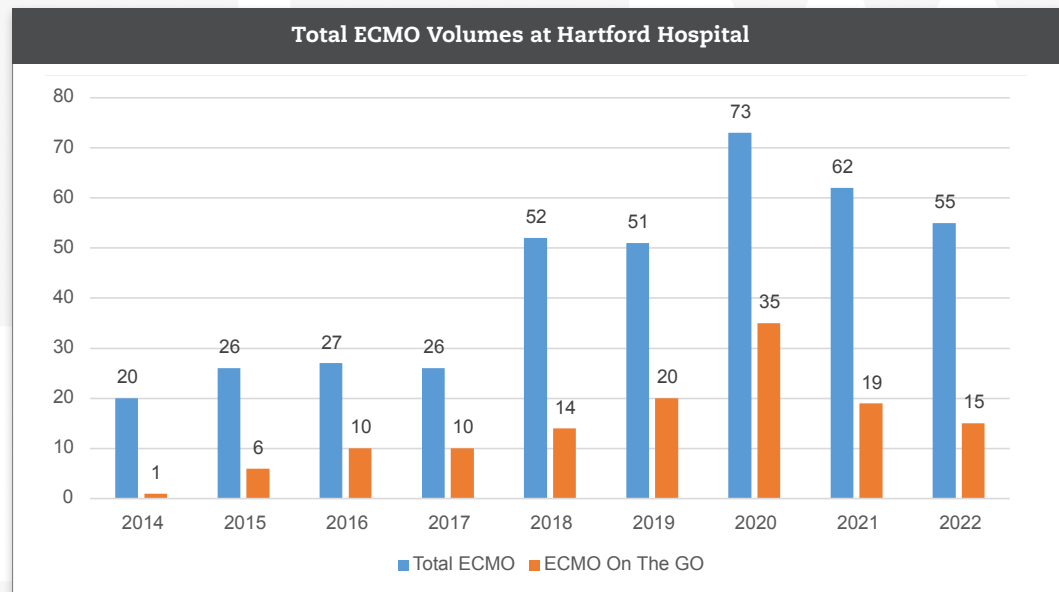
Contact

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Expanding ECMO Indications

Working in concert with Jason Gluck, DO, and other physicians from the Advanced Heart Failure and Mechanical Circulatory Support Department at Hartford Hospital, Dr. Underhill has been a leader in the use of ECMO, including ECMO-On-The-GO, at Hartford HealthCare.



2021-22 ECMO Peer-Reviewed Publications

1. Kois AK, Gluck JA, Nicolau DP, Kuti JL. Pharmacokinetics and Time above the MIC Exposure of Cefepime in Critically Ill Patients Receiving Extracorporeal Membrane Oxygenation (ECMO). *Int J Antimicrob Agents*. 2022 Jul;60(1):106603. doi: 10.1016/j.ijantimicag.2022.106603. Epub 2022 May 14. PMID: 35577257.
2. Labib A, August E, Agerstrand C, Frenckner B, Laufenberg D, Lavandosky G, Fajardo C, Gluck JA, Brodie D. Extracorporeal Life Support Organization Guideline for Transport and Retrieval of Adult and Pediatric Patients with ECMO Support. *ASAIO J*. 2022 Apr 1;68(4):447-455. doi: 10.1097/MAT.0000000000001653. PMID: 35184084.
3. Saeed O, Stein LH, Cavarocchi N, Tatoes AJ, Mustafa A, Jorde UP, Alvarez C, Gluck J, Saunders P, Abrol S, De Anda A, Goldstein DJ, Silvestry S. Outcomes by cannulation methods for venovenous extracorporeal membrane oxygenation during COVID-19: A multicenter retrospective study. *Artif Organs*. 2022 Aug;46(8):1659-1668. doi: 10.1111/aor.14213. Epub 2022 Mar 8. PMID: 35191553; PMCID: PMC9111408.
4. Saeed O, Tatoes AJ, Farooq M, Schwartz G, Pham DT, Mustafa AK, D'Alessandro D, Abrol S, Jorde UP, Gregoric ID, Radovancevic R, Lima B, Bryner BS, Ravichandran A, Salerno CT, Spencer P, Friedmann P, Silvestry S, Goldstein DJ; COVID-19 ECMO Working Group. Characteristics and outcomes of patients with COVID-19 supported by extracorporeal membrane oxygenation: A retrospective multicenter study. *J Thorac Cardiovasc Surg*. 2022 Jun;163(6):2107-2116.e6. doi: 10.1016/j.jtcvs.2021.04.089. Epub 2021 May 18. PMID:4112505; PMCID: PMC8130603.
5. Bascetta T, Bolton L, Kurtzman E, Hantzios W, Standish H, Margarido P, Race K, Spencer J, Baker W, Gluck J. Air Medical Transport of Patients Diagnosed With Confirmed Coronavirus Disease 2019 Infection Undergoing Extracorporeal Membrane Oxygenation: A Case Review and Lessons Learned. *Air Med J*. 2021 Mar-Apr;40(2):130-134.
6. Brewer JM, Tran A, Yu J, Ali MI, Poulos CM, Gates J, Underhill D, Gluck J. Application and outcomes of extracorporeal life support in emergency general surgery and trauma. *Perfusion*. 2021 Apr 21;2676591211009686.
7. Brewer JM, Tran A, Yu J, Ali MI, Poulos CM, Gates J, Gluck J, Underhill D. ECMO after cardiac surgery: a single center study on survival and optimizing outcomes. *J Cardiothorac Surg*. 2021 Sep 19;16(1):264.
8. Kutzler HL, Poulos CM, Cheema F, O'Sullivan DM, Ali A, Ebcioğlu Z, Einstein M, Feingold A, Gluck J, Hammond JA, Jaiswal A, Lawlor MT, Morgan G, Radojevic JA, Rochon C, Sheiner P, Singh JU, Sotil EU, Swales C, Ye X, Serrano OK. COVID-19 in solid organ transplant recipients: observations from Connecticut. *Transplantation*. 2021; 105: e6-e8.
9. Saeed O, Tatoes AJ, Farooq M, Schwartz G, Pham DT, Mustafa AK, D'Alessandro D, Arbol S, Jorde UP, Gregoric ID, Radovancevic R, Lima B, Bryner BS, Ravichandran A, Salerno CT, Spencer P, Friedmann P, Silvestry S, Goldstein DJ; COVID-19 ECMO Working Group. Characteristics and outcomes of patients with COVID-19 supported by extracorporeal membrane oxygenation: A retrospective multicenter study. *J Thorac Cardiovasc Surg*. 2021 May 18:S0022-5223(21)00801-1.



Daniel S. Fusco, MD
Cardiac Surgeon

Biography

Daniel S. Fusco, MD, received a bachelor of science degree in engineering from the University of Connecticut in 1986 and a master of science degree in electrical engineering from Worcester Polytechnic Institute in 1993. Between 1986 and 1990, he also worked for the General Electric Company in various departments as an Edison engineer including, the Aircraft Instruments and Underwater Warfare divisions.

He went on to receive his medical degree from the University of Connecticut School of Medicine in 1995, followed by completion of a General Surgery internship and residency at Baystate Medical Center between 1995 and 2000, a Thoracic Surgery residency at Virginia Commonwealth University between 2000 and 2002, and a Fellowship in Heart Transplantation and Aortic Surgery at Yale University between 2002 and 2005. He has since served as a board-certified cardiothoracic surgeon at the University of Connecticut John Dempsey Hospital, Hartford Hospital and St. Vincent's Medical Center.

Education

Fellowship

Medical College of Virginia
Yale New Haven Hospital

Graduate School

Worcester Polytechnic
Institute

Internship

Baystate Medical Center (MA)

Medical School

University of Connecticut
School of Medicine

Undergraduate

University of Connecticut

Areas of Expertise

Coronary artery bypass surgery, extra corporeal membrane oxygenation, heart transplantation, heart valve surgery, maze and mini maze for atrial fibrillation, mechanical circulatory support, open thoracic aortic surgery, pacemakers, surgery for hypertrophic obstruction cardiomyopathy (HOCM).

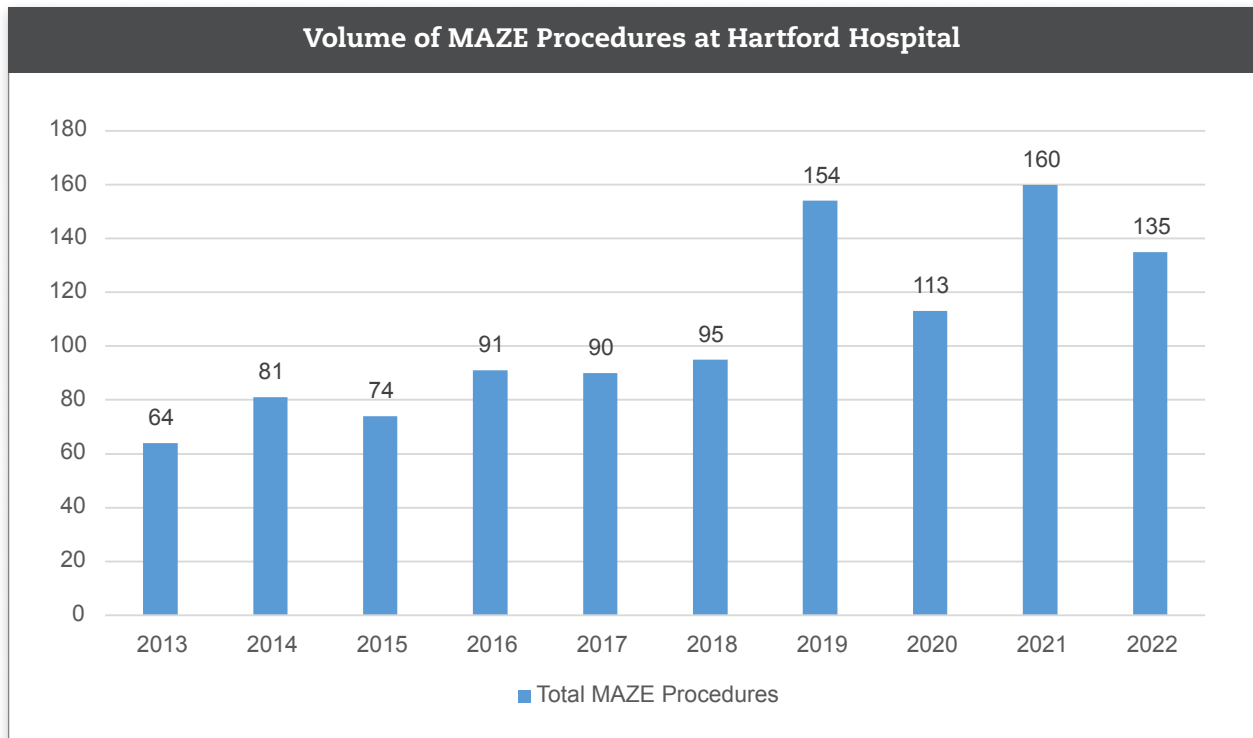
Contact

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Surgical Treatment of Atrial Fibrillation:

Among his many areas of expertise, Dr. Fusco has focused on the surgical treatment of atrial fibrillation with the MAZE procedure with and without concomitant left atrial appendage exclusion using the AtriClip. In addition, he has performed hybrid ablation and the convergent ablation procedures performed as a multidisciplinary approach with electrophysiologists. During his time at Hartford Hospital, he has contributed significantly to the increasing surgical volume of patients treated for chronic atrial fibrillation.



Recent Research Publications:

1. Fusco DS, Shaw RK, Tranquilli M, Kopf GS, Elefteriades JA. Femoral cannulation is safe for type A dissection repair. *Ann Thorac Surg.* 2004 Oct;78(4):1285-9; discussion 1285-9.
2. Gisnarian CJ, Fusco DS, Arciszewski M. A Novel Approach to Identifying How Equipment Disrupts the Airflow Patterns in the Operating Room. *J Extra Corpor Technol.* 2021 Jun;53(2):130-136.



Sheelagh M. Pousatis, MD
Cardiac Surgeon

Biography

Sheelagh M. Pousatis, MD, graduated magna cum laude from Muhlenberg College with a bachelor of science degree in biology in 2011, where she completed the Muhlenberg Scholars Honor Program. She went on to receive her MD degree from Georgetown University School of Medicine in 2015, and then completed a six-year integrated thoracic surgery residency at the University of Maryland Medical Center between 2015 and 2021. Joining Hartford HealthCare in 2021, Dr. Pousatis has had extensive training in adult cardiac surgery with a special focus on mitral valve repair, as well as transcatheter techniques including transcatheter aortic valve replacement, MitraClip mitral valve repair and TEVAR.

Education

Internship

University of Maryland
Medical Center

Medical School

Georgetown University
School of Medicine

Residency

University of Maryland
Medical Center

Areas of Expertise

Aortic valve replacement, coronary artery bypass surgery, endovascular treatment of thoracic aortic disease, heart valve surgery, maze procedure, mechanical circulatory support, mitra clip for mitral regurgitation, mitral valve repair, mitral valve replacement/repair, open thoracic aortic surgery, transcatheter aortic valve replacement (TAVR), transcatheter mitral valve repair (TMVR).

Contact

Hartford Hospital

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Recent Research Publications

1. Ziegler LA, Pousatis S, Kaczorowski DJ, Madathil RJ. Emergency Splicing of Transected Ventricular Assist Device Driveline. *Ann Thorac Surg*. 2021 May;111(5):e329-e331.
2. Li M, Mazzeffi MA, Gammie JS, Banoub M, Pazhani Y, Herr D, Madathil R, Pousatis S, Bathula A. Characterization of Postoperative Infection Risk in Cardiac Surgery Patients With Delayed Sternal Closure. *J Cardiothorac Vasc Anesth*. 2020 May;34(5):1238-1243.
3. Pasrija C, Kronfli A, Rouse M, Raithel M, Bittle GJ, Pousatis S, Ghoreishi M, Gammie JS, Griffith BP, Sanchez PG, Kon ZN. Outcomes after surgical pulmonary embolectomy for acute submassive and massive pulmonary embolism: A single-center experience. *J Thorac Cardiovasc Surg*. 2018 Mar;155(3):1095-1106.
4. Pasrija C, Kronfli A, Rouse M, Raithel M, Bittle GJ, Pousatis S, Ghoreishi M, Gammie JS, Griffith BP, Sanchez PG, Kon ZN. Outcomes after surgical pulmonary embolectomy for acute submassive and massive pulmonary embolism: A single-center experience. *J Thorac Cardiovasc Surg*. 2018 Mar;155(3):1095-1106.



Rafael P. Squitieri, MD

*Chief, Cardiothoracic Surgery, St Vincent's Medical Center;
Vice Chairman, Cardiac Surgery, Hartford HealthCare
Heart & Vascular Institute; Co-Director, Hybrid Atrial
Fibrillation Program, St. Vincent's Medical Center*

Biography

Rafael P. Squitieri, MD, received his bachelor of arts undergraduate degree from Columbia College in 1989 and his MD degree from Mount Sinai School of Medicine in 1993. He performed his general surgery residency at Morristown Memorial Hospital between 1993 and 1998, where he served as chief resident, and his cardiothoracic surgery residency at Mount Sinai Medical Center between 1998 and 2001. He joined St. Vincent's Medical Center in 2001, where he has worked as a board-certified cardiothoracic surgeon. He currently serves as the chief of cardiothoracic surgery and chairman of the Department of Cardiovascular Services.

Dr. Squitieri has been the principal leader in the develop of cardiothoracic surgery at St. Vincent's Medical Center and has worked closely with hospital's interventional cardiologists to develop a vigorous structural heart program. He has received numerous honors and awards for his service, published multiple articles in peer-reviewed journals, and is the holder of multiple medical patents.

Education

Fellowship

Morristown Memorial Hospital

Internship

Morristown Memorial Hospital

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Areas of Expertise

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Recent Research Publications

1. Squitieri RP, DiMeco AC. Left-sided robotic thoracic duct clipping for chylothorax. *J Thorac Cardiovasc Surg.* 2013 Jan;145(1):299-300.
2. Hagl C, Ergin MA, Galla JD, Spielvogel D, Lansman S, Squitieri RP, Griep RB. Delayed chronic type A dissection following CABG: implications for evolving techniques of revascularization. *J Card Surg.* 2000 Sep-Oct;15(5):362-7.
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Research & Innovation

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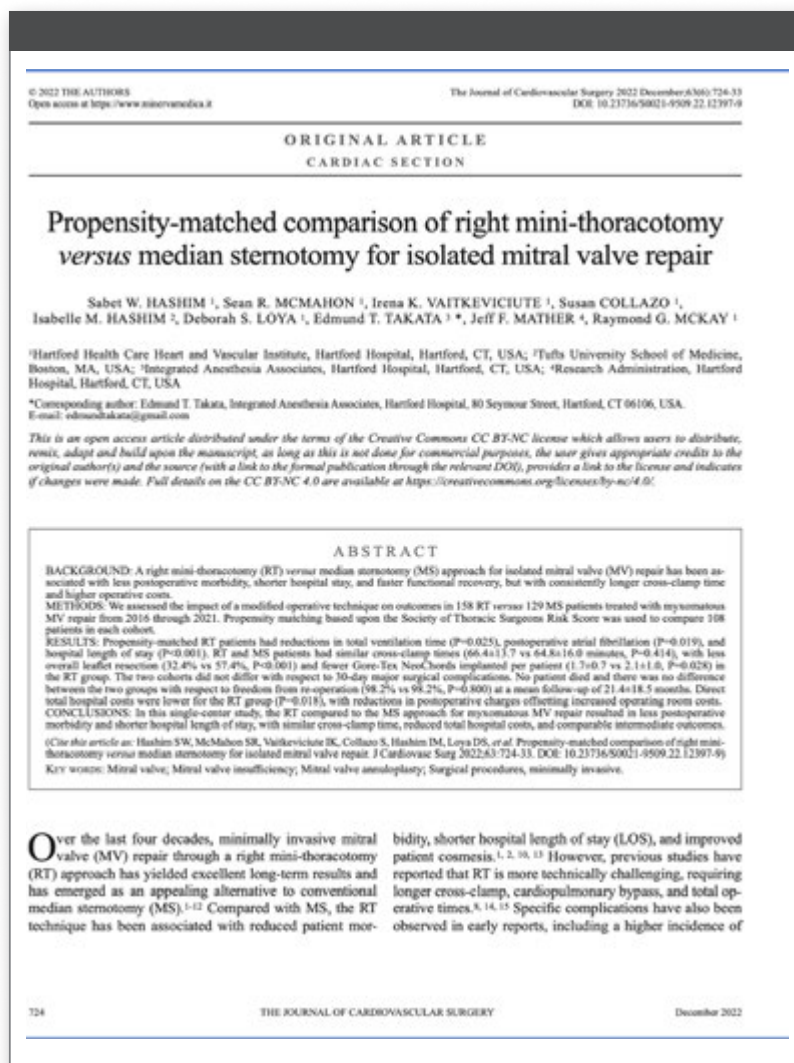
This serves as a resource for investigators, patients and potential sponsors interested in learning and potentially becoming involved in current HVI research endeavors. It is our privilege to support our clinicians and research colleagues as they contribute to advances in cardiovascular and vascular medicine and improved care for our patients.

Reducing Operatives Times and Direct Hospital Costs with Right Mini-Thoracotomy Mitral Valve Repair

Over the last four decades, minimally-invasive mitral valve (MV) repair through a right mini-thoracotomy (RT) approach has yielded excellent long-term results and has emerged as an appealing alternative to conventional median sternotomy (MS). Compared with MS, the RT technique has been associated with reduced patient morbidity, shorter hospital length of stay and improved patient satisfaction. However, previous studies have reported that RT is more technically challenging, requiring longer cross-clamp, cardiopulmonary bypass, and total operative times. The effect of RT on total hospital costs has been variable, yet surgical supply and operating room expenses have consistently been higher.

In a 2022 report by Sabet Hashim, MD, a propensity-matched comparison between 108 RT and 108 MS patients undergoing MV repair for myxomatous mitral regurgitation demonstrated shorter total ventilation times, less postoperative atrial fibrillation, and a shorter hospital length of stay in the RT cohort. Notably, RT and MS patients had similar cross-clamp times, with no significant differences in hospital outcomes and late clinical follow-up. Among the advances in surgical technique detailed by Dr. Hashim leading to shorter operative times were three time-saving methodologies, including the tendency to

restrict posterior leaflet resection, a targeted employment of NeoChords resulting in fewer implanted NeoChords per patient, and use of the posterior imbrication technique in lieu of the sliding leaflet technique to prevent SAM. Additionally, Dr. Hashim reported that direct total hospital costs were lower for the RT group, with reductions in RT postoperative charges offsetting increased operating room costs.



Using Machine Learning to Predict Mitral Valve Surgery Outcomes

In concert with investigators from the Massachusetts Institute of Technology Operations Research Center and Sloan School of Management and the USC Marshall School of Business, Robert Hagberg, MD, published a 2022 study entitled “Machine Learning Models for Mitral Valve Replacement: A Comparative Analysis with the Society of Thoracic Surgeons Risk Model” (*J Card Surg.* 2021 Oct 20). Operative risk for patients who are currently referred for mitral valve surgery typically is assessed using the Society of Thoracic Surgery (STS) risk score calculator to predict morbidity and mortality associated. Examining outcomes of 383,550 mitral valve surgery procedures from the STS Adult Cardiac Surgery Database from 2008-2017, the investigators successfully applied machine learning techniques to construct novel risk models for predicting mortality, prolonged ventilation, renal failure, stroke and deep sternal wound infection following mitral valve replacement. The investigators found that machine learning analysis, which encompassed more than 300 variables for each procedure, produced risk models that were more accurate than the existing STS risk calculator, particularly for mortality, prolonged ventilation and renal failure.

The results of this landmark study represent one of the first published analyses on the use of advanced machine learning methods for the prediction of surgical risk in the context of mitral valve surgery. Moreover, combining the power of a large dataset from the largest national cardiac surgery registry with the innovative logic of machine learning, the investigators have shown that artificial intelligence can be successfully used in the field of medical prediction to provide clinicians with user-friendly tools that can be easily incorporated in their practice and improve risk-benefit analysis and recommendations for patients contemplating mitral valve surgical intervention.

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ORIGINAL ARTICLE JOURNAL OF
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Machine learning models for mitral valve replacement: A comparative analysis with the Society of Thoracic Surgeons risk score

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Abstract
Background: Current Society of Thoracic Surgeons (STS) risk models for predicting outcomes of mitral valve surgery (MVS) assume a linear and cumulative impact of variables. We evaluated postoperative MVS outcomes and designed mortality and morbidity risk calculators to supplement the STS risk score.
Methods: Data from the STS Adult Cardiac Surgery Database for MVS was used from 2008 to 2017. The data included 383,550 procedures and 89 variables. Machine learning (ML) algorithms were employed to train models to predict post-operative outcomes for MVS patients. Each model's discrimination and calibration performance were validated using unseen data against the STS risk score.
Results: Comprehensive mortality and morbidity risk assessment scores were derived from a training set of 287,662 observations. The area under the curve (AUC) for mortality ranged from 0.77 to 0.83, leading to a 3% increase in predictive accuracy compared to the STS score. Logistic Regression and eXtreme Gradient Boosting achieved the highest AUC for prolonged ventilation (0.82) and deep sternal wound infection (0.78 and 0.77) respectively. eXtreme Gradient Boosting performed the best with an AUC of 0.815 for renal failure. For permanent stroke prediction all models performed similarly with an AUC around 0.67. The ML models led to improved calibration performance for mortality, prolonged ventilation, and renal failure, especially in cases of reconstruction/repair and replacement surgery.
Conclusions: The proposed risk models complement existing STS models in predicting mortality, prolonged ventilation, and renal failure, allowing healthcare providers to more accurately assess a patient's risk of morbidity and mortality when undergoing MVS.

KEYWORDS
artificial intelligence, heart, machine learning, mitral valve surgery

Defining Carotid Access as the Optimal Alternative Access Approach for Transcatheter Aortic Valve Replacement

Despite the availability of lower profile vascular sheaths and valve delivery systems for transcatheter aortic valve replacement (TAVR), approximately 5-15% of TAVR patients currently require alternative vascular access because of unsuitable iliofemoral anatomy that prevents use of the conventional transfemoral approach. Alternative TAVR access routes that have been previously described include the transapical, direct aortic, transcaval, subclavian/axillary, transcarotid and intravascular lithotripsy facilitated transfemoral approaches. In recent years, the transcarotid approach has been proposed as the optimal alternative access TAVR technique with the lowest rate of major complications compared to other alternative access strategies and with hospital costs that are equivalent to the traditional transfemoral approach. Notably, Hartford Hospital has been among a small number of TAVR centers in the STS/ACC TVT registry that have pioneered the use of transcarotid TAVR, and recently was designated the first carotid TAVR training center in the country.

Transcarotid Versus Transfemoral Transcatheter Aortic Valve Replacement (from a Propensity-Matched Comparison)

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Previous reports comparing transcarotid (TC) versus transfemoral (TF) approaches for patients undergoing transcatheter aortic valve replacement have had inconsistent conclusions. We compared in-hospital and 1-year clinical outcomes, changes in quality of life, and direct hospital costs for 138 TC versus 1,926 TF procedures. Propensity matching based on the Society of Thoracic Surgery Predicted Risk of Mortality was used to compare 130 patients who underwent TC with 813 patients who underwent TF. Matched TC versus TF cohorts did not differ with respect to in-hospital mortality (0.0% vs 1.4%, $p = 0.380$), stroke (2.3% vs 2.5%, $p = 0.917$), major vascular complications (0.8% vs 2.2%, $p = 0.268$), composite bleeding complications (4.6% vs 6.4%, $p = 0.647$), requirement for permanent pacemaker (14.6% vs 12.9%, $p = 0.426$), postoperative hospital length of stay (3.3 ± 3.4 vs 3.1 ± 3.3 days, $p = 0.467$), or direct hospital costs ($\$52,899 \pm 9,560$ vs $\$50,464 \pm 10,997$, $p = 0.230$). Similarly, at 1-year, patients who underwent TC versus patients who underwent TF did not differ with respect to all-cause mortality (7.6% vs 6.4%, $p = 0.659$), hospital readmission (20.0% vs 23.9%, $p = 0.635$), or quality of life as measured by the Kansas City Cardiomyopathy Questionnaire score (84.0 ± 17.1 vs 88.4 ± 13.9 , $p = 0.062$). Patients who underwent TC and TF did not differ with respect to in-hospital complications, length of hospital stay, and direct hospital costs, as well as 1-year mortality, readmission, and quality of life. These data add to ongoing support for the TC approach as the optimal alternative access for patients with transcatheter aortic valve replacement deferred from a transfemoral approach. © 2022 The Author(s). Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>) (Am J Cardiol 2022;00:1–9)

Introduction

Despite the availability of lower profile vascular sheaths and valve delivery systems for transcatheter aortic valve replacement (TAVR), approximately 5% to 15% of patients with TAVR currently require alternative vascular access because of unsuitable iliofemoral anatomy that prevents the use of the conventional transfemoral (TF) approach.¹ Alternative TAVR access routes that have been described over the last 2 decades include the transapical, direct aortic, transcaval, subclavian/axillary (TAX), and transcarotid (TC) approaches. Although each of these strategies may be suitable for a given patient based on anatomic constraints, there has been a gradual evolution in the use of different alternative access techniques.

As the first alternative access strategy that was used, transapical access has been progressively abandoned due to its invasiveness and consistent reports of increased mortality and morbidity, including increased stroke rates.^{2–5} A direct aortic approach was used in the landmark high- and intermediate-risk TAVR trials,^{6–8} but this strategy has likewise been supplanted by the TAX approach as the most common, currently-used alternative access route in the United States according to recent data from the Society of Thoracic Surgeons/American College of Cardiology Transcatheter Valve Therapy (STS/ACC TVT) registry.⁹ Notably, previous studies have demonstrated decreased mortality and shorter intensive care unit and hospital length of stay with the TAX approach compared with the transapical and direct aortic approaches.^{10,11}

First introduced in 2010, the TC TAVR approach has recently emerged as a possible alternative to the TAX technique.¹² Previous studies have demonstrated that the TC approach has higher success rates and fewer complications than the transapical and direct aortic strategies.^{12–14} Additional reports have demonstrated decreased stroke rates with TC versus TAX approaches.¹⁵ Despite these reports, TC TAVR has not gained widespread acceptance across the

In a 2022 study, Mohiuddin Cheema, MD, and colleagues compared clinical outcomes between the transcarotid approach and the standard transfemoral approach. Transcarotid and transfemoral patients did not differ with respect to in-hospital complications, length of hospital stay or direct hospital costs, as well as one-year mortality, re-admission and quality of life. This data adds to ongoing support for the transcarotid approach as the optimal alternative access for TAVR patients deferred from a transfemoral access.

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See page 7 for disclosure information.

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Reducing Perioperative Bleeding for Coronary Artery Bypass Surgery with Appropriate Thienopyridine Discontinuation

Prior studies have demonstrated that dual antiplatelet therapy (DAPT) with aspirin and an oral P2Y₁₂ receptor inhibitor is more effective than aspirin alone in reducing recurrent thrombotic events and mortality in patients hospitalized with acute coronary syndromes (ACS). Approximately 10 to 15% of ACS patients, however, require CABG following cardiac catheterization that reveals multivessel or left main coronary artery disease. Despite the benefit of DAPT in preventing recurrent ischemic events while awaiting surgical intervention, an increased risk of major bleeding complications has been reported in CABG patients who continue to receive P2Y₁₂ inhibitors within five days of surgery. This time course of thienopyridine discontinuation has recently been challenged for specifically for ticagrelor.

In 2022, Joseph Ingrassia, MD, a in concert with the cardiac surgery department, published a manuscript describing the time course of withdrawal of thienopyridines needed to avoid CABG bleeding. Examining outcomes in more than 2,000 CABG patients treated at Hartford Hospital, Dr. Ingrassia found that clopidogrel exposure within five days of CABG was an independent predictor of bleeding complications, whereas major ticagrelor bleeding effects were confined to drug exposure within three days of surgery. Dr. Ingrassia's recommendation that only three days of discontinuation are required for ticagrelor is supported by recently updated 2021 ACC/AHA guidelines.



Contents lists available at ScienceDirect

Cardiovascular Revascularization Medicine



Impact of ticagrelor versus clopidogrel on bleeding outcomes of isolated coronary artery bypass grafting

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ABSTRACT

Background: Increased bleeding risks have been documented in patients exposed to P2Y₁₂ inhibitors within 5 days of coronary artery bypass surgery (CABG). This study aimed to determine the relative CABG bleeding risks of clopidogrel versus ticagrelor exposure and the proper time course of ticagrelor discontinuation prior to surgery.

Methods: Clinical outcomes were assessed in 2075 isolated CABG patients, including 375 who had received P2Y₁₂ inhibitors within 5 days of surgery (155 clopidogrel, 213 ticagrelor, 7 prasugrel). BARC-4 CABG bleeding complications and perioperative blood product usage were assessed in propensity-matched P2Y₁₂-inhibited and non-P2Y₁₂-inhibited cohorts.

Results: P2Y₁₂-inhibited patients (n = 375) in comparison to matched non-P2Y₁₂-inhibited patients (n = 1138) had higher rates of re-operation for bleeding (3.8 % vs 1.3 %, p = 0.003), postoperative red blood cell transfusion ≥5 units (5.7 % vs 2.7 %, p = 0.007), and intraoperative and postoperative blood product utilization (42.3 % vs 27.1 %, p < 0.001; 41.8 % vs 32.2 %, p < 0.001, respectively). Univariate predictors of BARC-4 bleeding included clopidogrel (OR: 2.145, 95 % CI: 1.131–4.067, p = 0.019) and ticagrelor discontinued within 3 days of surgery (OR: 2.153, 95 % CI: 1.003–4.169, p = 0.049). Multivariate logistic regression demonstrated that only clopidogrel exposure was an independent BARC-4 bleeding predictor (OR: 1.850, 95 % CI: 1.007–3.398, p = 0.048). Unadjusted ticagrelor patients with drug discontinuation 4–5 days prior to CABG only demonstrated higher rates of perioperative platelet transfusion, without additional signs of excessive bleeding.

Conclusions: Clopidogrel exposure within 5 days of CABG is an independent predictor of BARC-4 bleeding, whereas major ticagrelor bleeding effects are confined to drug exposure within 3 days of surgery.

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Previous studies have demonstrated that dual antiplatelet therapy (DAPT) with aspirin and an oral P2Y₁₂ receptor inhibitor (e.g., clopidogrel, ticagrelor, prasugrel) is more effective than aspirin alone in reducing recurrent thrombotic events and mortality in patients hospitalized with acute coronary syndromes (ACS) [1,2]. Approximately 10–15 % of patients admitted with ACS, however, require coronary artery bypass grafting (CABG) following cardiac catheterization that reveals multivessel or left main coronary artery disease. Despite the benefit of DAPT in preventing recurrent ischemic events while awaiting surgical intervention, an increased risk of major bleeding complications has been reported in CABG patients who continue to receive P2Y₁₂ inhibitors within 5 days of surgery [3–8]. Notably, in this subpopulation of CABG patients, prior studies have reported an increased risk of re-operation for bleeding and tamponade, increased intraoperative and postoperative blood product utilization, and longer postoperative length of stay.

Although previous studies have documented increased CABG-related bleeding with all oral P2Y₁₂ inhibitors, there have been differing reports on the relative bleeding risks of different agents and on the specific time course required for ticagrelor discontinuation to minimize bleeding risks. While the 2011 American College of Cardiology/American Heart Association (ACC/AHA) guidelines recommended a 5- to 7-day ticagrelor washout period before surgical intervention [9], more recent reports have suggested that delaying surgery for 72 h is likely sufficient [10]. As a result, the current European Society of Cardiology (ESC) guidelines [11] and the recently updated 2021 ACC/AHA

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Using ERAS to reduce Racial and Ethnic Disparities Associated with Coronary Artery Bypass Grafting

Widespread racial and ethnic disparities have been previously reported in patients undergoing coronary artery bypass grafting (CABG). The implementation of an Enhanced Recovery after Surgery (ERAS) clinical pathway has been proposed as a way to reduce outcome disparities following non-cardiac surgery, but has not been examined in patients requiring CABG.


In combination with Trevor Sutton, MD, from the Hartford Hospital Department of Anesthesia, cardiac surgery investigators published a 2022 report documenting the benefits of using the ERAS to reduce patient morbidity and shorten hospital stay in patients requiring coronary bypass surgery, and specifically documented that this approach resulted in a reduction of healthcare disparities between white and minority patient subgroups with respect to readmission to the intensive care unit and postoperative length of stay. This important study demonstrates the utility of ERAS not only as a quality improvement initiative, but also as a health equity initiative.



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Original Article

Enhanced Recovery After Surgery Is Associated With Improved Outcomes and Reduced Racial and Ethnic Disparities After Isolated Coronary Artery Bypass Surgery: A Retrospective Analysis With Propensity-Score Matching

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Objective: To evaluate whether enhanced recovery after surgery (ERAS) protocol implementation was associated with improved outcomes and decreased racial and ethnic outcome disparities after isolated coronary artery bypass graft (CABG) surgery.

Design: A retrospective analysis of an institutional CABG database with propensity-score matching.

Setting: At a single tertiary care teaching hospital.

Participants: One thousand seven hundred thirty-five patients undergoing isolated CABG: 656 patients from 2016 to 2017 (pre-ERAS) and 1,079 patients from 2018 to 2020 (post-ERAS). Each patient cohort was divided into a White subgroup and a racial and ethnic minorities (Minorities) subgroup.

Interventions: None

Measurements and Main Results: Propensity-matched post-ERAS patients (n = 584) compared to pre-ERAS patients (n = 584) demonstrated reductions in total length of stay (LOS) (median [interquartile range]): (7 [5-10] v 8 [6-11.5] days, p = .006), postoperative LOS (5 [4-7] v 5 [4-7] days, p = .001), total ventilation time (6.1 [4.8-9.5] v 6.6 [5.2-10.9] hours, p = .004), postoperative morphine milligram equivalents (mean ± standard deviation): 68.6 ± 57.5 v 100.0 ± 59.4, p < .001), and increased likelihood of early extubation (48.8% v 42.3%, p = .026); the Minorities subgroup demonstrated reductions in likelihood of intensive care unit (ICU) readmission (1.3% v 8.1%, p = .012) and postoperative morphine milligram equivalents (73.6 ± 64.0 v 107.8 ± 71.9, p < .001). Logistic regression models demonstrated that disparities in ICU readmission and postoperative LOS between White and Minorities patients were eliminated post-ERAS.

Conclusions: ERAS for isolated CABG surgery was associated with reduced total and postoperative LOS, reduced total ventilation time, and increased early extubation for all patients, as well as reduced ICU readmission for the Minorities subgroup. ERAS implementation was associated with reduced disparities between White and racial and ethnic minority patients for ICU readmission and postoperative LOS.

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Key Words: enhanced recovery after surgery; ERAS; coronary artery bypass surgery; racial and ethnic disparities

Expanding the Boundaries of Cardiac Transplantation

More than 3,500 people in the United States are currently waiting for a heart transplant, and many will have to wait more than six months before a heart becomes available from the limited donor pool. Unfortunately, some patients will die before a heart becomes available, fueling attempts to identify potential donors who have not been previously accepted.

A 2022 report by Abhishek Jaiswal, MD, from the Hartford Hospital Advanced Heart Failure, in concert with investigators from the University of Connecticut School of Pharmacy and the Cleveland Clinic, surveyed 162,586 patients from the Scientific Registry of Transplant Recipients (SRTR) to identify the use of heart transplant donors with impaired renal function, defined as having an estimated glomerular filtration rate ≤ 30 ml/min. Notably, of the 22,780 patients (14%) with renal impairment, more than two-thirds of the hearts from this group were discarded and not used for transplantation. Despite this finding, heart transplant recipients from donors with renal dysfunction fared well with non-significant differences in primary graft failure and a lower adjusted mortality compared to recipients from donors without renal impairment. Dr. Jaiswal and his co-authors conclude, "Increased evaluation and utilization of donors with renal dysfunction has the potential to expand the critically low donor pool."

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ORIGINAL ARTICLE

Cardiac donors with renal impairment: Usage and outcomes after heart transplant

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Abstract

Introduction: Utilization of hearts from donors with significant renal dysfunction and the impact of donor renal function on outcomes following heart transplant (HT) is unknown. We sought to investigate the trends, characteristics and outcomes associated with these donor hearts and the impact of donor renal function on survival and graft failure in adult-HT recipients.

Methods: We reviewed the Scientific Registry of Transplant Recipients (SRTR) and summarized trends, characteristics and outcomes of hearts from adult donors by renal impairment. Single-organ HTs were evaluated and stratified to donors with estimated glomerular filtration rate (eGFR) $<$ and ≥ 30 ml/min. We constructed Cox proportional hazards regression models to compare time-to-mortality over 30-day, 1-, 3-, and 5-year time horizons between groups, and the association of donor eGFR group with graft failure.

Results: A total of 162,586 adults were evaluated for cardiac donation, of which, 22,780 (14%) had an eGFR ≤ 30 ml/min. Donors with an eGFR ≤ 30 ml/min increased over time, from 7.2% (358,489/4) in 2000 to a high of 19.5% (2263/11,726) in 2020. Such donors were significantly more likely discarded (not offered) (7.9% vs. 9.6%, $p < .001$) or accepted (63.4% vs. 73.3%, $p < .001$), and less likely to be transplanted (10.0% vs. 23.5%, $p < .000$). Of 41,044 HT recipients, 3958 (9.7%) had hearts from such donors. Primary graft failure was similar between groups (OR 1.20, 95% CI .91–1.55, $p = .11$) while adjusted mortality was lower for recipients from donors with eGFR ≤ 30 ml/min.

Conclusions: More than two-third of hearts from donors with renal dysfunction are discarded. Recipients from donors with renal dysfunction sustained lower mortality post-HT during the study period. Increased evaluation and utilization of donors with renal dysfunction has the potential to expand the critically low donor pool.

KEYWORDS:
donor renal function, graft failure, heart transplant, survival

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ADULT CIRCULATORY SUPPORT

Post Heart Transplantation Outcomes of Patients Supported on Biventricular Mechanical Support

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Metrics

Abstract

With the implementation of the new heart transplant (HT) allocation system, patients requiring biventricular support systems have the highest priority, a shorter waitlist time, and a higher frequency of HT. However, the short-term and long-term outcomes of such patients are often disputed. Hence, we examined the outcomes of these patients who underwent HT before change in allocation scheme. Additionally, we compared post-HT outcomes of extracorporeal membrane oxygenation (ECMO) with other nondischageable biventricular (BiVAD) supported patients. We identified adult ECMO or BiVAD supported HT recipients between 2000 and 2018 in the Scientific Registry of Transplant Recipients database. We compared survival with the Kaplan-Meier method. Using overlap propensity score weighting, we constructed Cox proportional hazards regression models to determine the risk-adjusted influence of BiVAD versus ECMO on survival. Of the 730 patients HT recipients; 528 (72.3%) and 202 (27.7%) were bridged with BiVAD and ECMO, respectively. For BiVAD versus ECMO patients, the 30-day, 1-year, 3-year, and 5-year mortality rates were 8.0% versus 14.4%, 16.3% versus 21.3%, 22.4% versus 25.3%, and 26.3% versus 25.7%, respectively. Risk-adjusted post-HT survival of BiVAD and ECMO patients at 30-day (HR 1.24 [95% CI, 0.68–2.27]; $P = 0.4863$), 1-year (HR 1.29 [95% CI, 0.80–2.09]; $P = 0.3009$), 3-year (HR 1.27 [95% CI, 0.83–1.94]; $P = 0.2801$), and 5-year (HR 1.35, 95% CI, 0.90–2.05; $P = 0.1501$) were similar. Around three-fourth of the ECMO or BiVAD supported patients were alive at 5-years post-HT. The short-term and long-term post-HT survivals of groups were comparable.

Understanding Heart Transplant Outcomes of Patients on Biventricular Mechanical Support and ECMO

Recent changes in the heart transplant (HT) allocation system have identified patients on biventricular support as those individuals with the highest priority for transplantation. There have been contrasting reports on the short- and long-term outcomes of this patient cohort.

In this 2022 report, Hartford Hospital investigators examined the Scientific Registry of Transplant Recipients between 2000 and 2018 to identify 730 HT recipients requiring either BiVAD support ($n=528$) or use of extracorporeal membrane oxygenation (ECMO) ($n=202$). BiVAD and ECMO-bridged patients did not differ with respect to risk-adjusted 30-day, 1-, 3- and 5-year survival. Notably, approximately three-fourths of the BiVAD and ECMO-supported patients were alive at five-years post-HT.

Defining ECMO Outcomes Post-Cardiac Surgery

Patients who develop severe myocardial dysfunction following cardiac surgery and require mechanical circulatory support with extracorporeal membrane oxygenation (ECMO) represent a high-risk cohort with increased morbidity and mortality. To delineate prognostic factors of survival in this patient subset, a retrospective analysis of 60 patients who underwent cardiac surgery and required peri-operative ECMO was performed. Of these patients, 52 (86.6%) had refractory cardiogenic shock, 7 (11.6%) had pulmonary insufficiency, and 1 (1.6%) had hemorrhagic shock. All patients required either venous-arterial (VA) (n=53, 88.3%), venous-venous (VV) (n=5, 8.3%), or venous-arterial-venous (VAV) (n=2, 3.3%) ECMO for hemodynamic support.

Overall in-hospital mortality was 60.7% (n = 37). Patients who survived were younger (52 ± 3.3 vs 66 ± 1.5 , $p < 0.001$) with longer hospital stays (35 ± 4.0 vs 20 ± 1.5 , $p < 0.03$). Survivors required fewer blood products (13 ± 2.3 vs 25 ± 2.3 , $p = 0.02$) with a net negative fluid balance (-3.5 ± 1.6 vs 3.4 ± 1.6 , $p = 0.01$). Cardiac re-operations worsened survival.

ECMO is a viable rescue strategy for cardiac surgery patients with a 40% survival to discharge rate. Careful attention to volume management and blood transfusion are important markers for potential survival.

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RESEARCH ARTICLE

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ECMO after cardiac surgery: a single center study on survival and optimizing outcomes



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Abstract

Background: The study purpose is to examine survival prognostic and extracorporeal membrane oxygenation (ECMO) application outcomes at our tertiary care center.

Methods: This is a retrospective analysis, January 2014 to September 2019. We analyzed 60 patients who underwent cardiac surgery and required peri-operative ECMO. All inpatients with demographic and intervention data was examined. 52 patients (86.6%) had refractory cardiogenic shock, 7 patients (11.6%) had pulmonary insufficiency, and 1 patient (1.6%) had hemorrhagic shock, all patients required either venous-arterial (VA) (n = 53, 88.3%), venous-venous (VV) (n = 5, 8.3%) or venous-arterial-venous (VAV) (n = 2, 3.3%) ECMO for hemodynamic support. ECMO parameters were analyzed and common postoperative complications were examined in the setting of survival with comorbidities.

Results: In-hospital mortality was 60.7% (n = 37). Patients who survived were younger (52 ± 3.3 vs 66 ± 1.5 , $p < 0.001$) with longer hospital stays (35 ± 4.0 vs 20 ± 1.5 , $p < 0.03$). Survivors required fewer blood products (13 ± 2.3 vs 25 ± 2.3 , $p = 0.02$) with a net negative fluid balance (-3.5 ± 1.6 vs 3.4 ± 1.6 , $p = 0.01$). Cardiac re-operations worsened survival.

Conclusion: ECMO is a viable rescue strategy for cardiac surgery patients with a 40% survival to discharge rate. Careful attention to volume management and blood transfusion are important markers for potential survival.

Keywords: Cardio-thoracic surgery, ECMO, Cardiac transplantation, Critical care, LVAD, Cardiac surgery

Background

Myocardial dysfunction after cardiac surgical intervention occurs in about 3–8% of patients [1, 2]. Patients are typically separated from cardiopulmonary bypass with inotropes/vasopressors or intra-aortic balloon counterpulsation [3–5]. In the event of refractory cardiac and/or pulmonary dysfunction additional mechanical circulatory support may be required. Extracorporeal membrane oxygenation (ECMO) is a bridging mechanical circulatory support with promising results seen in a multitude of post cardiectomy procedures with poor residual cardiac

function [1, 6–9]. Prognostic factors previously identified include: preventing left ventricular overloading, pulmonary edema, lung injury, and myocardial damage. Additional prognostic indicators are low oxygen pressure and low oxygen saturation of ECMO tubing, advanced age, pre-operative co-morbidities, the type of surgical procedure, and high blood product requirement [10–17]. We analyzed 60 patients who underwent cardiac surgery and required peri-operative ECMO support from January 2014 to September 2019. The purpose of this study is to delineate prognostic factors of survival, discuss the outcomes, and elaborate on the application of ECMO at a tertiary care center.

