11th ANNUAL HEART FAILURE UPDATE 2024

Friday May 24 - Saturday May 25

Marriott Chateau Champlain, Montreal, Quebec

CHFS SCIC Canadian Heart Failure Society
Société canadienne d'insuffisance cardiaque

𝕏 @CanHFSociety #HFupdate

Plenary 4: Hit Me With Your Best Shock

Plenary Opening Remarks

Justin Ezekowitz
MB, BCH, MSc, FRCPC, FACC, FAHA, FESC

Faculty

Co-chairs:

- Justin Ezekowitz, MB, BCH, MSc, FRCPC, FACC, FAHA, FESC
- Michael Felker, MD, MHS, FACC, FAHA, FHFSA

Presenters:

- Adriana Luk, MD
- Thomas Hanff, MD
- Jennifer Cowger, MD
- Michael McDonald, MD, FRCPC
- Jonathan Howlett, MD

Disclosures

	Dr. Justin Ezekowitz	Dr. Michael Felker
Any direct financial payments including receipt of honoraria	AstraZeneca, Bayer, Boehringer Ingelheim, Novartis, Novo Nordisk, Otsuka; serves as an advisor to US2.ai.	Novartis, BMS, Cytokinetics, Innolife, Cardionomic, Boehringer-Ingelheim, Abbott, Regeneron, Reprieve, Myovant, Sequana, Windtree Therapuetics, Amgen, Merck, Medtronic, EBR Systems, Rocket Pharma, V-Wave, LivaNova
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All other investments or relationships that could be seen by a reasonable, well-informed participant as having the potential to influence the content of the educational activity	CCS, CHFS, AHA, ESC, ACC, HFSA, AHS, UofA, CVC	No disclosures

Plenary Agenda

TIME	TOPIC
2:20 p.m. – 2:25 p.m.	**Plenary Opening Remarks** Dr. Justin Ezekowitz
2:25 p.m. – 2:40 p.m.	**Shock Pathways and Regional Shock Programs-Canada experience** Dr. Adriana Luk
2:40 p.m. – 2:55 p.m.	**Shock Pathways and Regional Shock Programs-USA experience** Dr. Thomas Hanff
2:55 p.m. – 3:10 p.m.	**Medical Management of Patients on Durable MCS Support** Dr. Jennifer Cowger
3:10 p.m. – 3:25 p.m.	**DEBATE: It's Time for Universal DT in Canada** Dr. Michael McDonald & Dr. Jonathan Howlett
3:25 p.m. – 3:40 p.m.	**Plenary Q&A** All panelists

Housekeeping

- To collect your MOC Section 1 credits, please remember to complete both the session evaluation and the congress evaluation
- The evaluation QR code can be found on your tables and will be displayed on the screen after the presentation

Hit Me With Your Best Shock

Shock Pathways and Regional Shock Programs- Canada Experience

Adriana Luk, MD, MSc, FRCPC
Cardiac Critical Care and Advanced Heart Failure
Toronto General Hospital, University Health Network
University of Toronto

May 25, 2024

Disclosures

- No disclosures

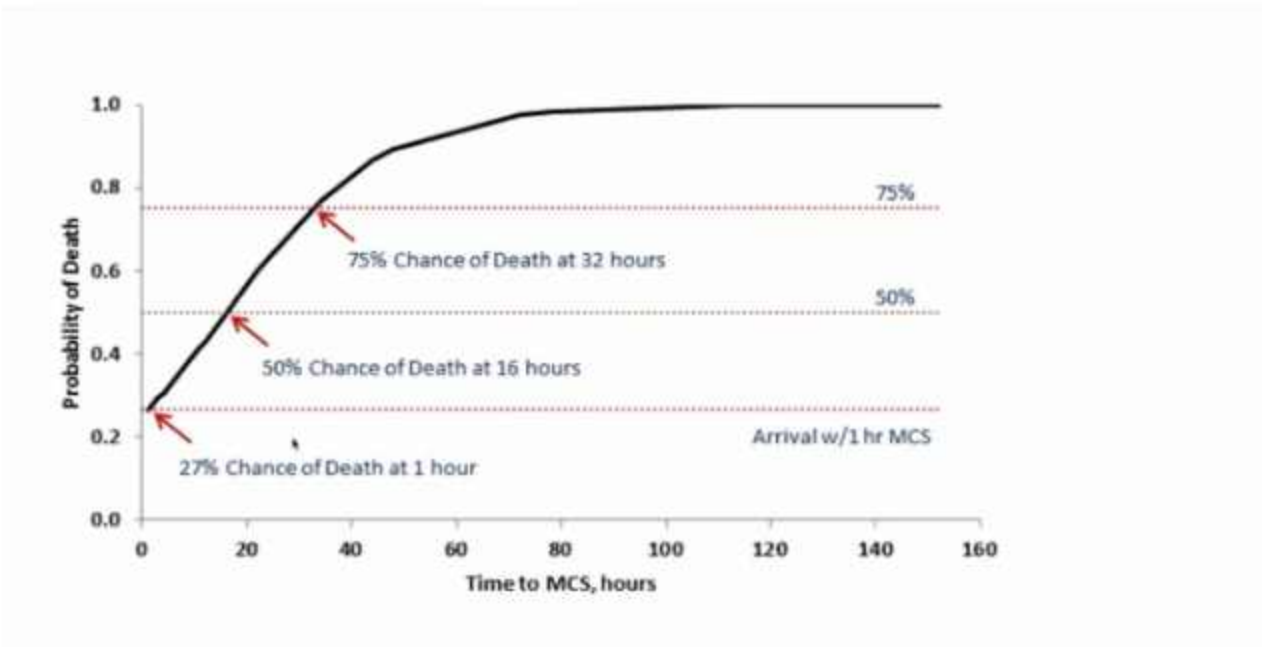
Learning Objectives

1. Summarize existing Shock Programs and experience in Canada
2. Contrast the specific needs for urban versus regional programs in Canada
3. Recognize key predictors for both individual patient and program success

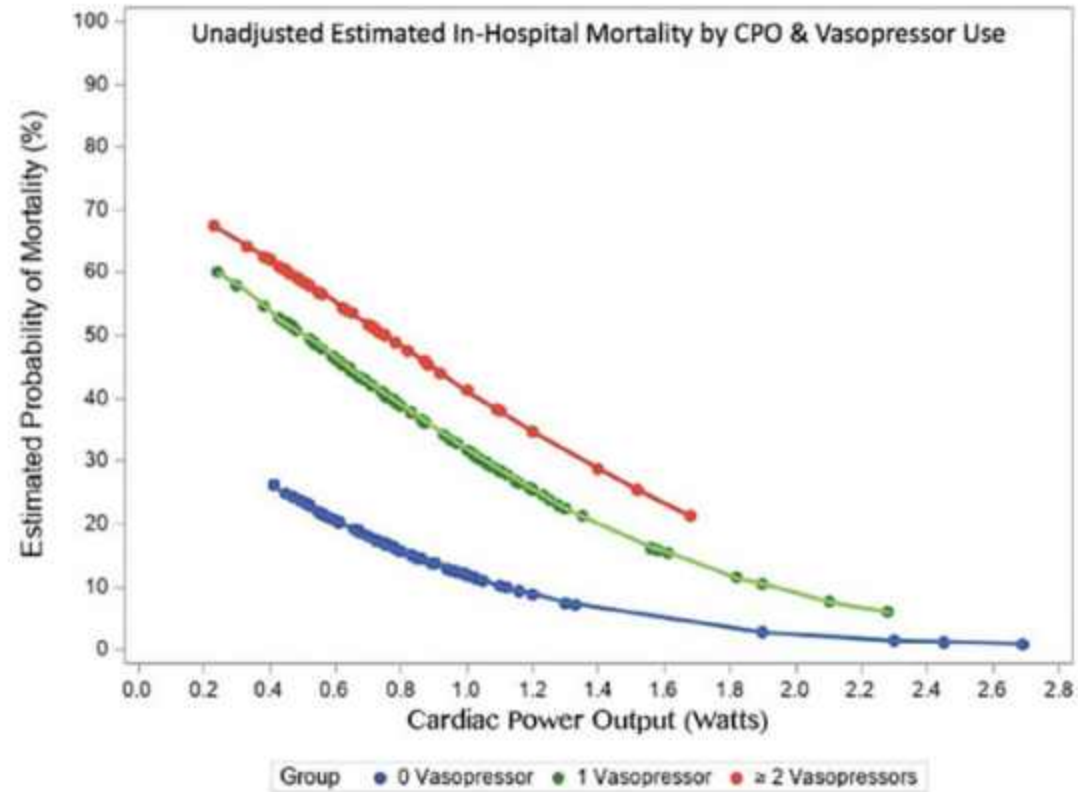
Hub CS Center

- What Shock programs exist across Canada?

Time is of the Essence



Tehrani et al. IHVI data



Basir M. CCI 2022 Feb;99 (3): 650-657.

The Canadian Cardiovascular Collaboratory

C3 Shock Working Group

- Shaun Goodman – Toronto
- Chris Fordyce – Vancouver
- Sean van Diepen - Edmonton
- Shuang bo Liu – Winnipeg
- Akshay Bagai – Toronto
- Adriana Luk – Toronto
- Derek So – Ottawa
- Jean-Francois Tanguay – Montreal
- Robert Avram – Montreal
- Juan Russo - Ottawa

Image credit to Dr. Derek So

Dr. Derek So, Ottawa Heart Institute

- Code SHOCK algorithm
- All CS calls → CICU team screening and trigger HF discussion/review, followed by Shock team discussion (virtually)

Strengths: Team-based decision making – 4 co-leads (HF, CVSx, critical care, IC)
Areas of improvement: Delay of communication from sending hospital, delay of timely transfer (EMS and Ornge), delay of shock team discussion, lack of critical care beds/OR/HR at receiving sites

Dr. Sean Van Diepen, University of Alberta

- All CS calls → HF team screening and trigger the SHOCK team players (virtual or in person)
- Patients sent to CICU (>4 hours out)

Strengths: Team-based decision making
Areas of improvement: Rapid North Alberta system- central communication- may take >20 minutes to get on a call, late adopters to CS team, adopters who revert to old processes

Dr. Robert Avram, Montreal Heart Institute

- Code SHOCK team built, no algorithm
- No local SHOCK network
- All CS calls → CICU team screening and trigger HF discussion/review who engages the players

Strengths: pending
Areas of improvement: pending

Dr. Christopher Fordyce, Vancouver General Hospital

- Code SHOCK team built, no algorithm—team not yet active
- No local SHOCK network
- All CS calls → vetted through team (CICU, ICU, IC, CSx, Anesthesia), activated via Locating

Strengths: pending
Areas of improvement: pending

UHN Experience

Started as a QI project in 2019

- Design a process that identifies patients who have CS in our network
- Standardize management of CS to allow universal access to care that is **equitable,** irrespective of which hospital a patient is admitted to
- Improve the survival of patients in CS by identifying and offering advanced therapies in those who are suitable candidates

PROJECT CHARTER

Title: Improving decision making of patients with cardiogenic shock (CS) who are admitted to the critical care units at Toronto General Hospital

Scope/Boundaries: Identifying which patients with Cardiogenic Shock are appropriate for transfer to the CICU at TGH, and once assessed, receive the necessary support (medical therapy, IABP, impella, tandem heart, ECLS, LVAD, transplant).

Team
Executive Sponsor: Heather Ross

Team Lead/Process Owner: Adriana Luk

Team Members:
HF/Tx: Michael McDonald, Phyllis Billia, Juan Duero Posada, Meredith Linghorne, Omid Kianamesh, Darhsan Brambhatt, Mehdi Afshar, Vicki Wang
MSICU: Eddy Fan, Ghislane Doufle
CICU: Patrick Lawler, Lindsay Love
Anestheisa/CVICU: Jane Heggie, Matteo Parotto
Interventional cardiology: Alan Barolet, Vlad Dzavik, Peter Seidelin
CV surgery: Mitesh Badiwala, Vivek Rao
PMCC: Linda Flockhart

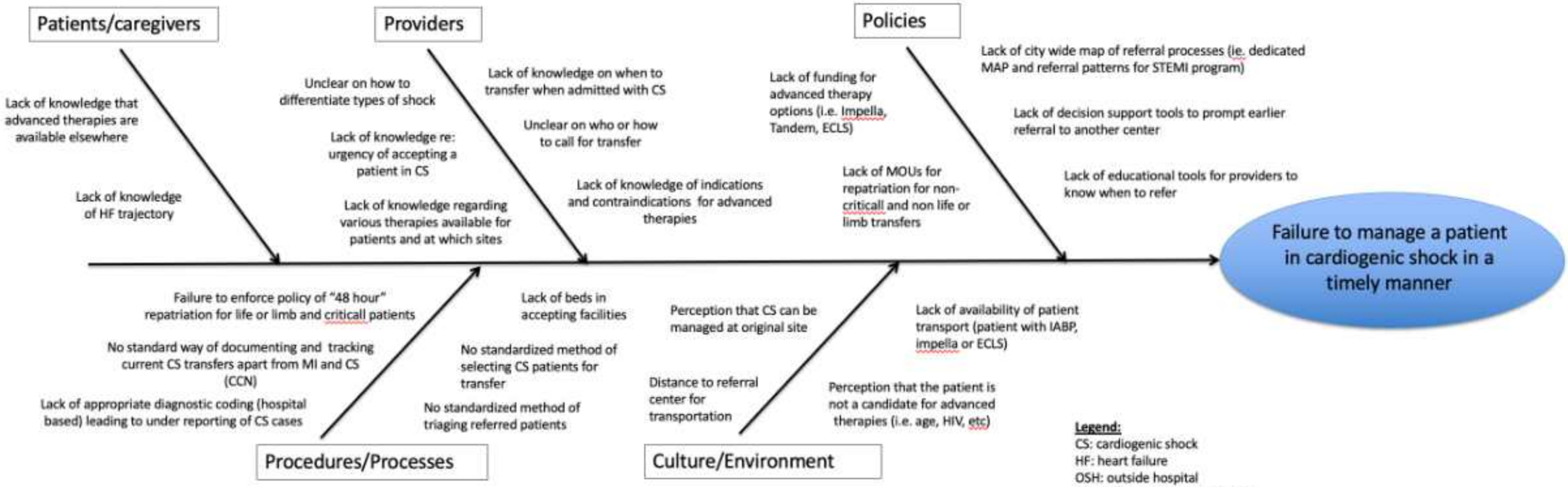
Community Partners:
Hamilton General Hospital: Faizan Amin, Craig Ainsworth
Joseph Brant Hospital: Saif Al-Mousawy
Oakville Trafalger: Michael Heffernan
Trillium Health Partners: Mangeet Chahal, Steve Singh, Geoffrey Puley
William Osler: Dominic Raco, Shy Amlani, Anne Marie (director for cardiac program), David Borts, Andrew Healey, Nicky Gaidu (cath lab manager)
St. Joseph: Peter Mitoff
Sunnybrook: Stephanie Poon, Tentative: Sam Radhakrishnan, Brad Strauss, Neil Adhikari, Gideon Cohen
St. Michael's Hospital: Howard Leong Poi, Akshay Bagai, Abdul AlHesayan

Problem Statement:

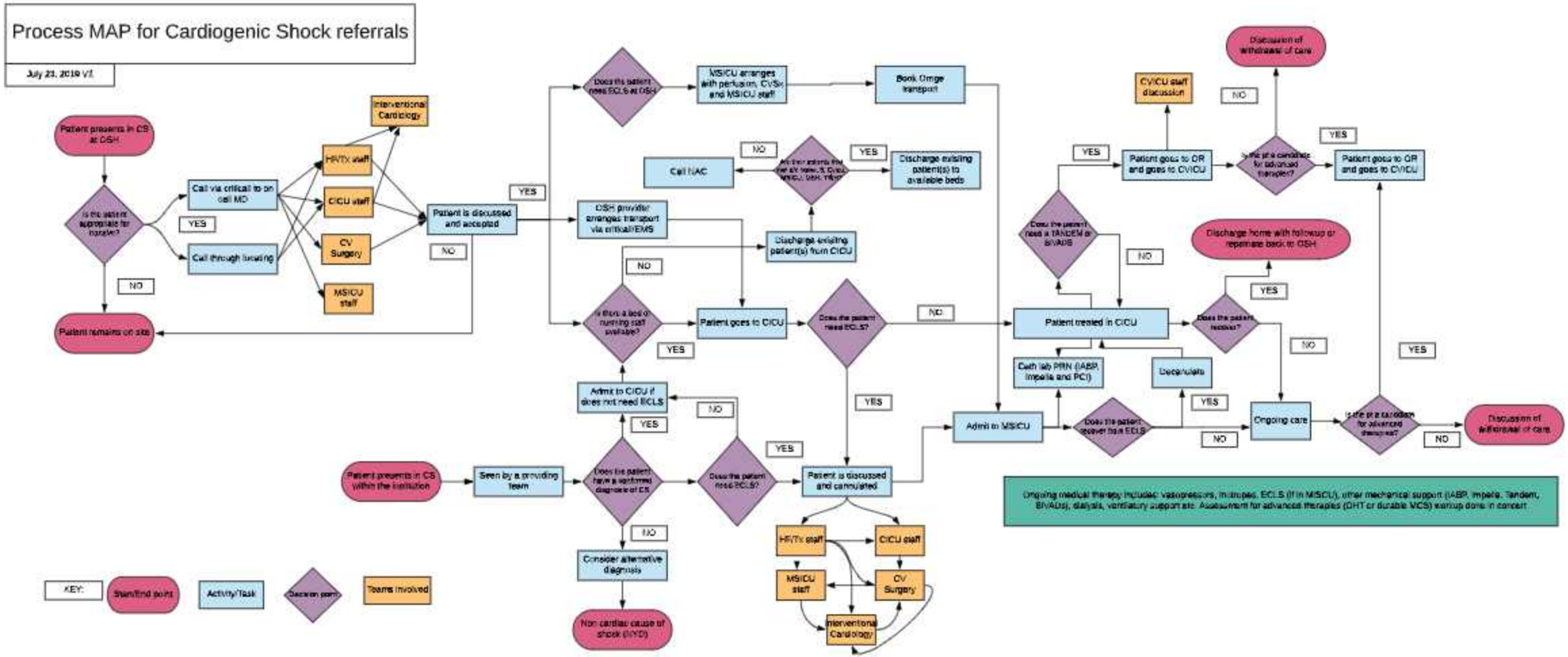
Cardiogenic shock is a multifactorial complex syndrome which can occur as a result of multiple etiologies, often associated with high mortality (approximately 50%)[1-4] Despite the advances of revascularization strategies and mechanical support, mortality remains unchanged. It has been proposed the timely recognition and early intervention can potentially alter the course.

In a review of our Jan 2014-Jan 2016 registry of CICU patients, 227 patients were admitted to our CICU with CS. Of those 76 were transferred from an outside hospital and 151 were admitted from our ER, clinic or from the hospital ward. Of those, mortality was found to be 30.8%, with 11 patients receiving an OHT and 19 receiving durable MCS. At our institution, there is no set protocol for the management of CS, and management is highly variable. There is growing evidence that a standardized team-based care for cardiogenic shock improves outcomes, with 30 day survival rates increasing to 76.6% (from 47%).[5]
With this in mind, there is a push to development regionalized systems of care as suggested by the AHA .[6]

We hope to improve referral of CS to our institution while ensuring that patients receive the appropriate treatment (medical vs. device therapy). In addition, we hope to develop a regional system of care of CS with our community partners with the goals to improve patient survival.

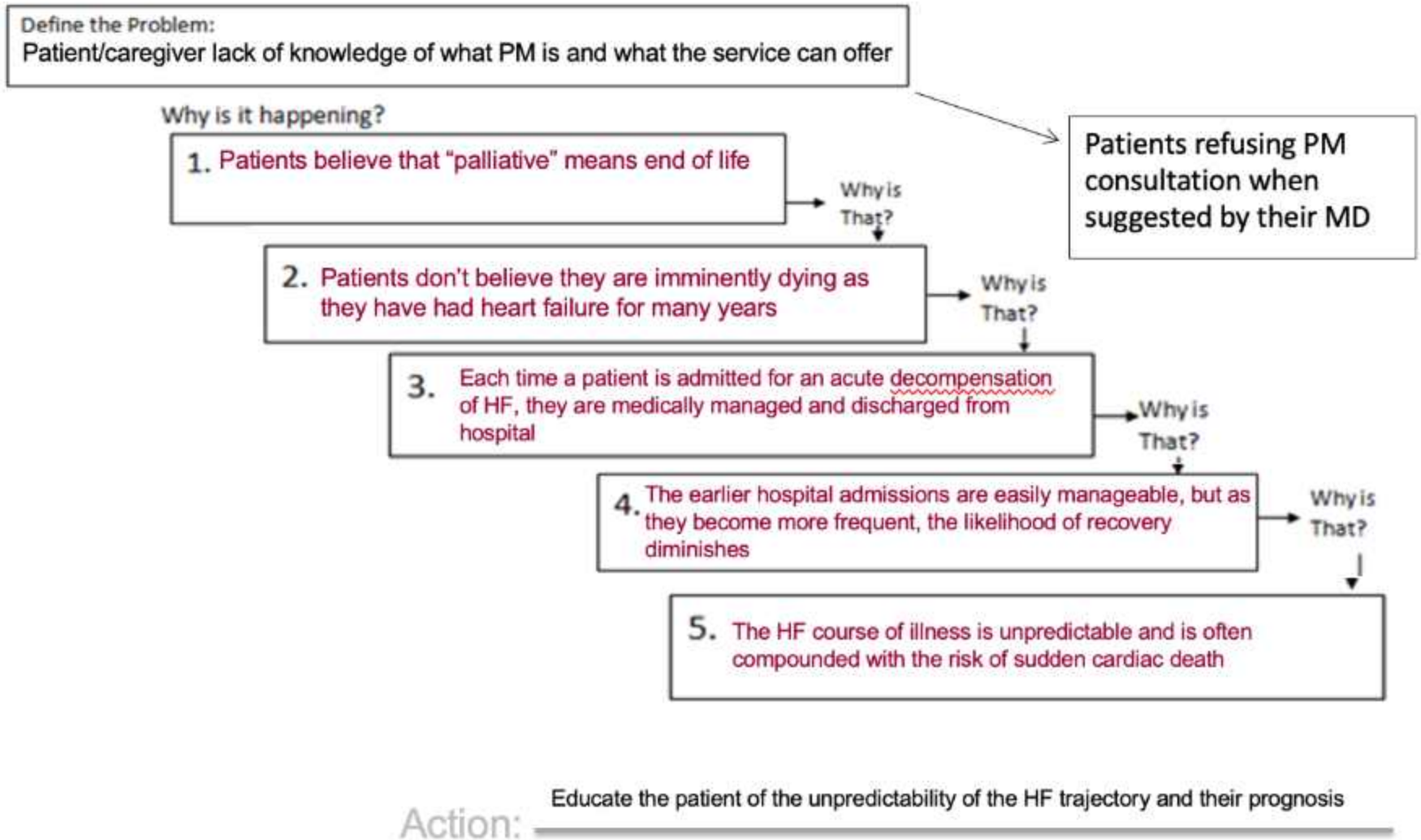


Legend:
CS: cardiogenic shock
HF: heart failure
OSH: outside hospital
ECLS: extracorporal life support
STEMI: ST elevation myocardila infarction
IABP: intra-aortic balloon pump
CCN: cardiac care network of Ontario


Process MAP for Cardiogenic Shock referrals
July 23, 2019 V1
Patient presents in CS at OSH
Is the patient appropriate for transfer?
YES
NO
Patient remains on site
Call via critical to on call MD
Call through bedding
Interventional Cardiology
HF/Tx staff
CICU staff
CV Surgery
MSICU staff
Patient is discussed and accepted
YES
NO
Does the patient need ECLS at OSH
MSICU arranges with perfusion, CVSx and MSICU staff
Book Omge transport
Call NAC
NO
Are there patients that the ICU team, S CVICU, MSICU, OSH, TRNC
YES
Discharge existing patient(s) to available beds
OSH provider arranges transport via critical/EMS
Discharge existing patient(s) from CICU
NO
Is there a bed + nursing staff available?
YES
Patient goes to CICU
Does the patient need ECLS?
NO
YES
Admit to CICU if does not need ECLS
NO
YES
Patient presents in CS within the institution
Seen by a providing team
Does the patient have a confirmed diagnosis of CS
Does the patient need ECLS?
YES
Patient is discussed and cannulated
NO
Consider alternative diagnosis
Non cardiac cause of shock (i/v/d)
HF/Tx staff
CICU staff
MSICU staff
CV Surgery
Interventional Cardiology
Admit to MSICU
Patient treated in CICU
Does the patient have a TANDEM or BIVADS
NO
YES
Cath lab PRN (IABP, Impella and PCI)
Decannulate
Does the patient recover from ECLS
YES
NO
Does the patient recover?
YES
NO
Discharge home with follow up or repatriate back to OSH
Ongoing care
Is the pt a candidate for advanced therapies?
YES
NO
Patient goes to OR and goes to CVICU
CVICU staff discussion
Discussion of withdrawal of care
Ongoing medical therapy includes: vasopressors, inotropes, ECLS (if in MSICU), other mechanical support (IABP, Impella, Tandem, BIVADs), dialysis, ventilatory support etc. Assessment for advanced therapies (OHT or durable MCS) warm up done in concert
KEY:
Start/End point
Activity/Task
Decision point
Teams involved

5 Whys Worksheet

1. Patient/caregiver



UHN/SHS Cardiogenic Shock algorithm and MCS selection

Patient with suspected cardiogenic shock

Defined as:
- Hypotension: sBP <90 mmHg for >30 min or use of vasopressors/inotropes to maintain sBP >90 mmHg OR CI <2.2 L/min/m² **AND**
- Hypoperfusion: evidence of end organ damage (ie.anuria, decreased LOC) or serial lactate rise >2

Exclusion Criteria
- Age >75 years
- Unwitnessed OHCA >30 minutes with unclear neurological status
- Confirmed other cause of shock
- Active bleeding or contraindication for systemic anticoagulation
- Pre-existing chronic condition with prognosis <1 yr

Page the HF staff to activate SHOCK team
Internal (14-3155) or External (CRITICALL)
Shock team members: CVSx, IC, CICU ± MSICU, anesthesia, perfusion

Identify CS phenotype- perform right heart cath
Perform ancillary testing: Labs, ECG, CXR, TTE, LHC, assess vascular anatomy if considering MCS

Ongoing team based management in the critical care unit
- Airway management
- Determine need of MCS
- Titration of vasopressors/inotropes
- Decongestion and/or Initiation of renal replacement therapy
- Initiation of advanced heart failure therapies
- Initiation of goals of care discussion
- Consultation with palliative medicine

REFRACTORY SHOCK despite medical management (SCAI D or E) or post cardiac arrest
CI <2.2 L/min/m² or CPO <0.6

SHOCK TEAM DISCUSSION for MCS
Call anesthesia if going to OR or cath lab

Isolated LV failure
RAP <12, PCWP >15, PAPi> 1.5

Is PaO2 <80?
- YES → VA ECMO
- NO → LV thrombus, mechanical AV or significant AI
  - YES → Surgical centrimag
  - NO → Impella 5.5
    Consider if:
    - Surgical LVAD is not an option
    - Exit strategy or a bridge to recovery

Isolated RV failure
RAP >12, PCWP <15, PAPi <1.5

Is PaO2 <80?
- YES → VA ECMO or Protek Duo or RVAD centrimag
- NO → Protek Duo or RVAD centrimag

Biventricular failure
RAP >12, PCWP >15, PAPi <1.5

Is PaO2 <80?
- YES → VA ECMO
- NO → VA ECMO or BiVAD centrimag

Peripheral VA ECMO: Consider Vent

Clinical considerations:
- No AV opening
- Severe refractory pulmonary edema
- Refractory arrhythmias

Call IC for septostomy
DO not use Impella or IABP

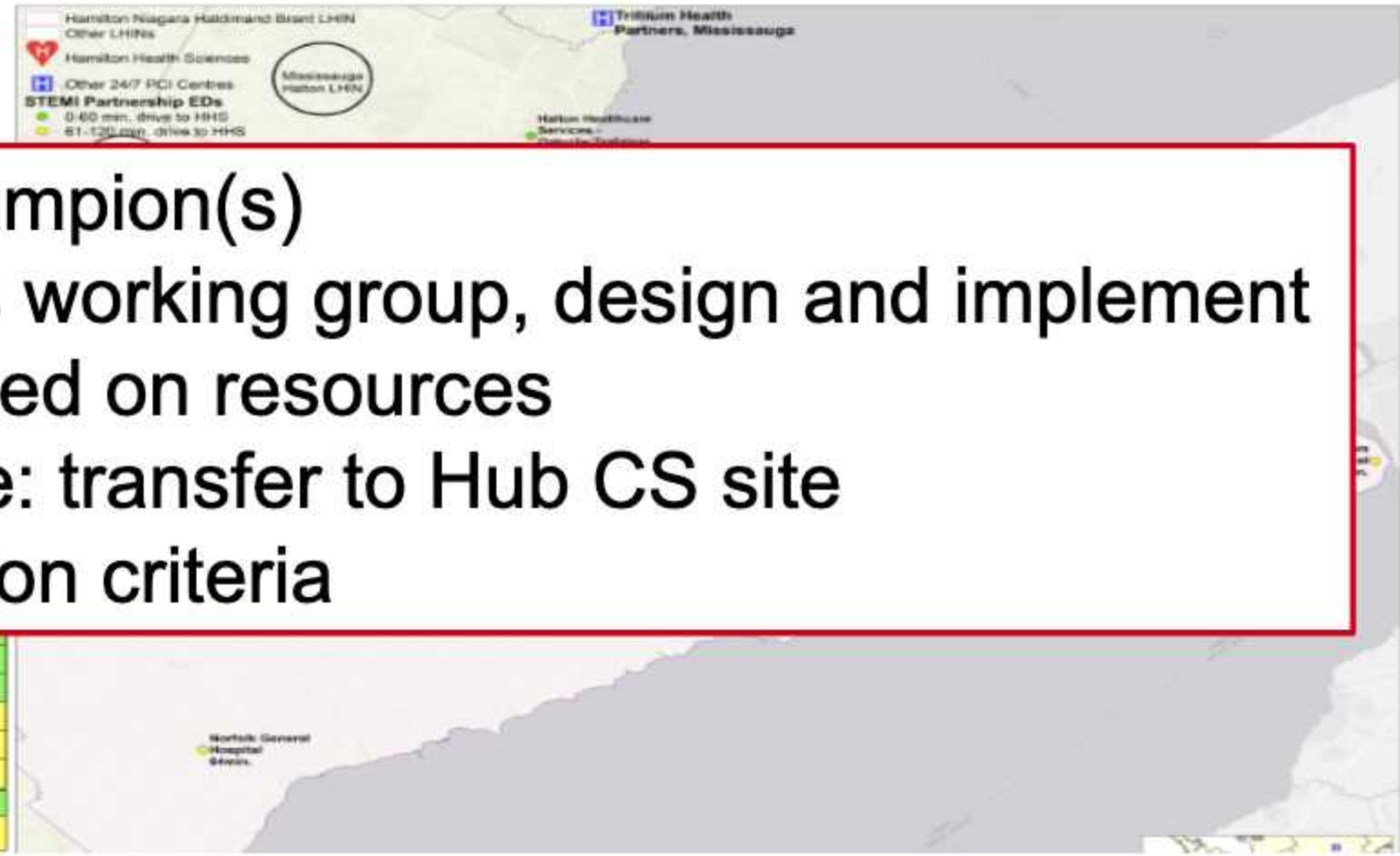
Cardiac power output (CPO)= MAP x CO/451
PAPI: sPAP-dPAP/RAP

Non-Hub CS Center

CARDIAC CARE NETWORK

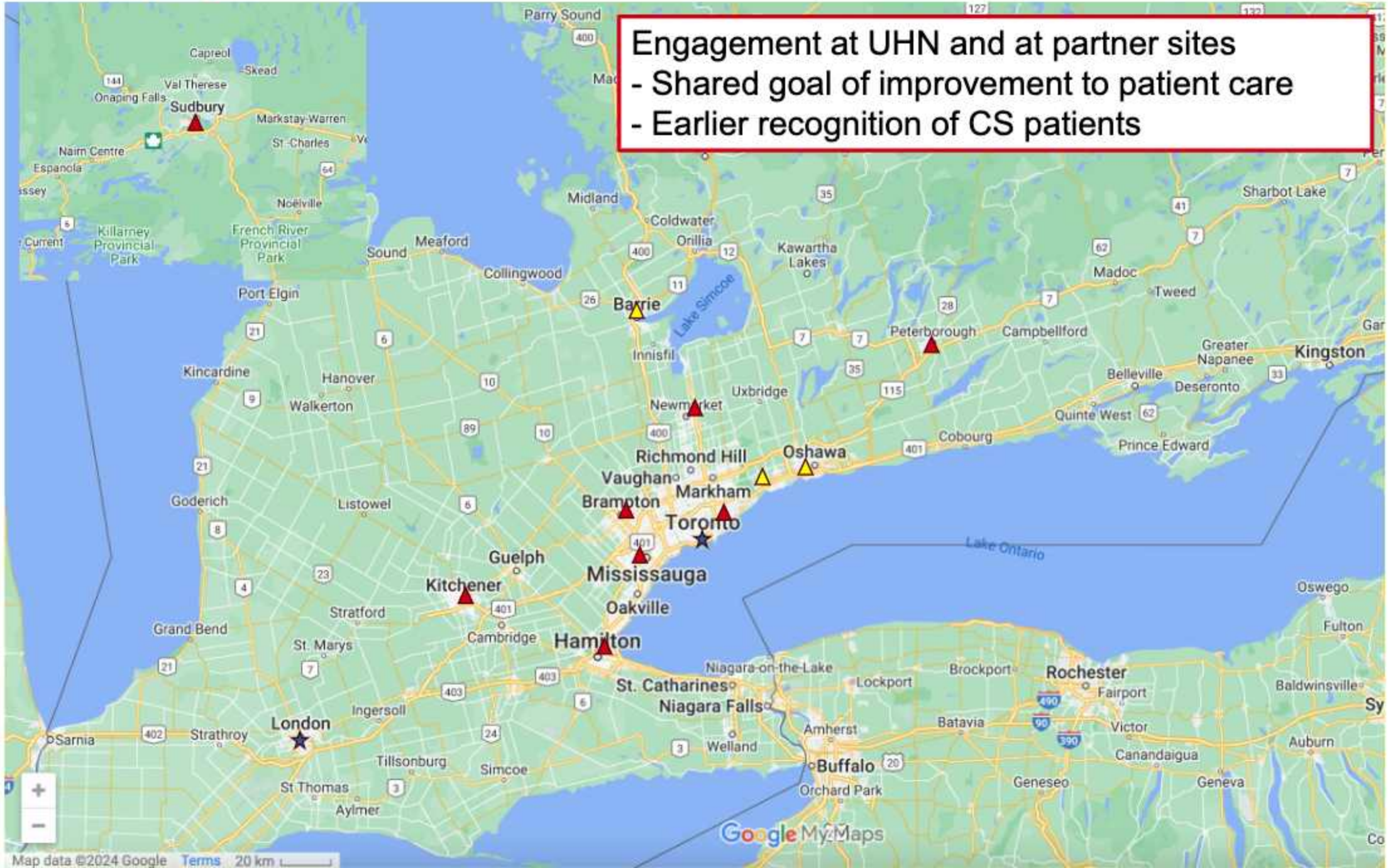
HAMILTON HEALTH SCIENCES (HHS)

- Identify on site champion(s)
- Each site identifies working group, design and implement local protocols based on resources
- Establish criteria re: transfer to Hub CS site
- Establish repatriation criteria



HNHB	Haldimand War Memorial Hospital	52
HNHB	Niagara Health System - Welland	60
HNHB	Norfolk General Hospital	64
HNHB	Niagara Health System - Douglas Memorial	65
HNHB	Niagara Health System - Port Colborne	70
Primary PCI: Target transfer to HHS ≤60 minutes		
Pharmacoinvasive: Target transfer to HHS ≤24 hours		

Program Success and Challenges


Engagement at UHN and at partner sites
- Shared goal of improvement to patient care
- Earlier recognition of CS patients
Parry Sound
Capreol
Skead
Val Therese
Onaping Falls
Sudbury
Markstay-Warren
St. Charles
Nairn Centre
Espanola
Noëlville
Killarney Provincial Park
French River Provincial Park
Midland
Coldwater
Orillia
Meaford
Sound
Collingwood
Port Elgin
Barrie
Lake Simcoe
Kawartha Lakes
Sharbot Lake
Madoc
Tweed
Peterborough
Campbellford
Greater Napanee
Kingston
Belleville
Deseronto
Innisfil
Uxbridge
Newmarket
Quinte West
Prince Edward
Cobourg
Kincardine
Hanover
Walkerton
Richmond Hill
Oshawa
Vaughan
Markham
Brampton
Toronto
Goderich
Listowel
Guelph
Mississauga
Kitchener
Oakville
Stratford
Grand Bend
St. Marys
Cambridge
Hamilton
Lake Ontario
Oswego
Fulton
Niagara-on-the-Lake
Lockport
Brockport
Rochester
Fairport
Baldwinsville
St. Catharines
Niagara Falls
Ingersoll
London
Sarnia
Strathroy
Amherst
Batavia
Victor
Auburn
Welland
Tillsonburg
Simcoe
Buffalo
Canandaigua
Geneseo
Geneva
St Thomas
Aylmer
Orchard Park
Google My Maps
Map data ©2024 Google
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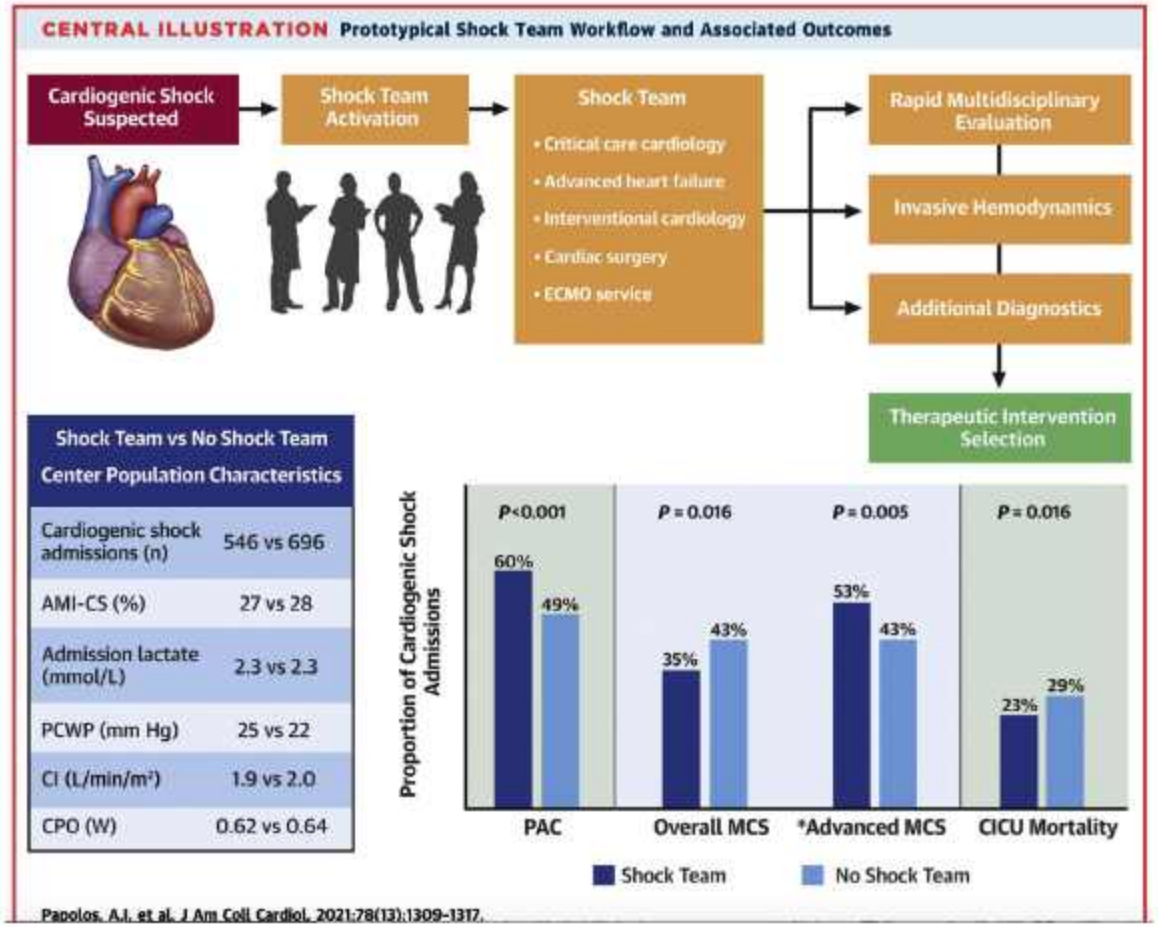
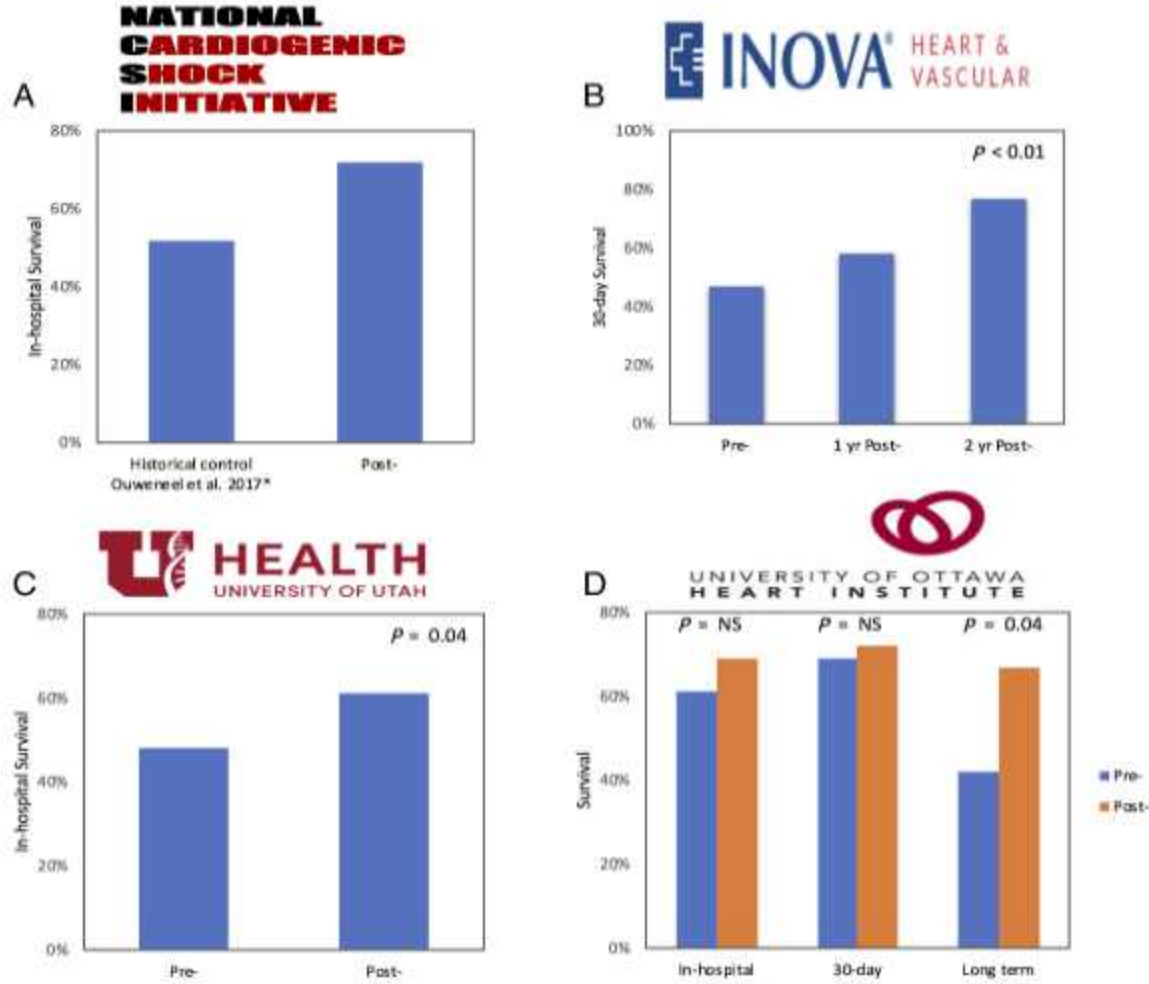
20 km

Use of SHOCK Teams





Moghaddam et al. ESC Heart Fail 2021 Apr;8(2):988.

Challenges

- Late adopters
- Retrogression
- Covid-19 pandemic
- Resource limitations
  - Human resources
  - Beds
  - Transportation delays
  - MCS funding

Shock Pathways and Regional Shock Programs

USA Experience

Tom Hanff
MD, MSCE, MPH
University of Utah

Disclosures

	Dr. Thomas Hanff
Any direct financial payments including receipt of honoraria	No disclosures
Membership on advisory boards or speakers' bureaus	No disclosures
Funded grants or clinical trials	Abiomed
All other investments or relationships that could be seen by a reasonable, well-informed participant as having the potential to influence the content of the educational activity	No disclosures

Learning Objectives

1. Summarize existing Shock Programs in the context of the USA
2. Recognize key predictors for both individual patient and program success
3. Contrast the specific needs for urban versus regional programs in the USA

History of the US Shock Team

- Travelling Shock Team @ Mayo Clinic Arizona

> J Heart Lung Transplant. 2011 Jun;30(6):618-23. doi: 10.1016/j.healun.2010.11.018.
Epub 2011 Jan 15.

A traveling team concept to expedite the transfer and management of unstable patients in cardiopulmonary shock

Dawn E Jaroszewski [1], Thomas Kleisli, Linda Staley, Christopher Pierce, Robert Scott, David Eric Steidley, Patrick DeValeria, Francisco A Arabia

History of the US Shock Team

- Team
  - CT surgeon or HF cardiologist
  - Perfusionist
  - ICU nurse
- Stabilize CS patient at a local hospital
- Decide on MCS prior to transfer
- Pilot study
  - 15/27 placed on VA-ECMO
  - 25/27 survived to transfer
  - 14/27 survived to discharge

Contemporary CS Team — On Site

- Core
  - Advanced HF cardiologist
  - CT surgeon
  - Interventional cardiologist
  - Intensivist
- Additional
  - Critical care nurse
  - Perfusionist
  - Respiratory therapist

Functions of a CS Team

Intake Conversation

- Management
- Therapeutic options
  - tMCS, revascularization, other intervention/surgery

Daily (or more) Rounding as a Consultative Team

- Escalation of therapy
- tMCS management
- Recovery vs need for LVAD/OHT
- Prevent/manage complications
  - Limb ischemia, bleeding

Three Essential Checkpoints

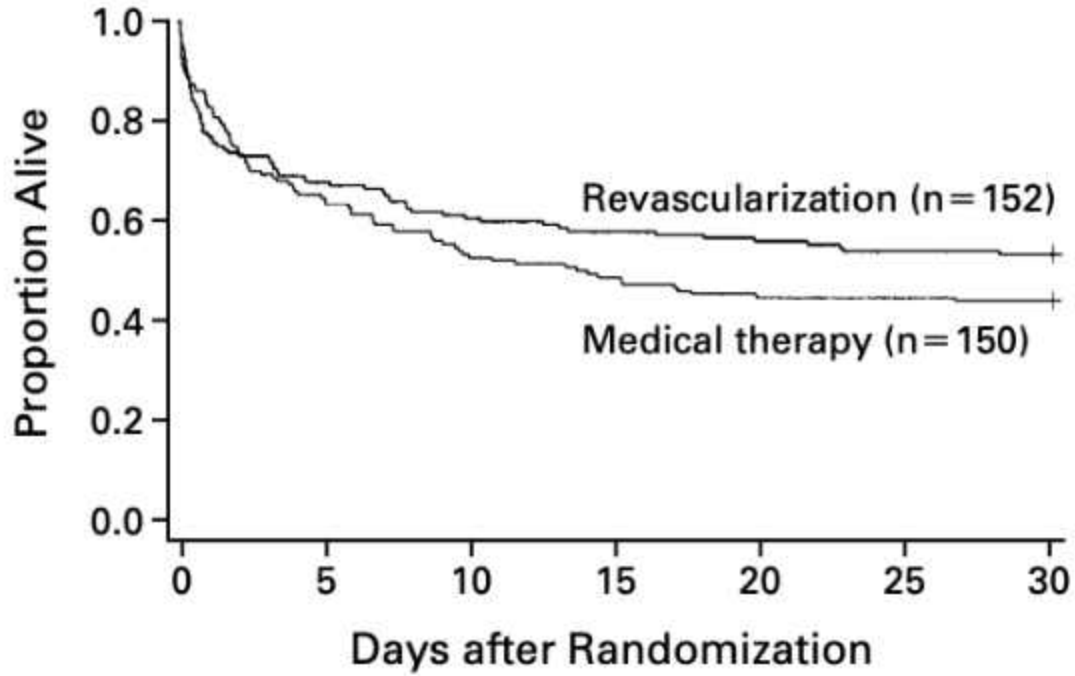
Invasive Hemodynamic Monitoring

Support Unstable STEMI for Revascularization

Early Mechanical Circulatory Support

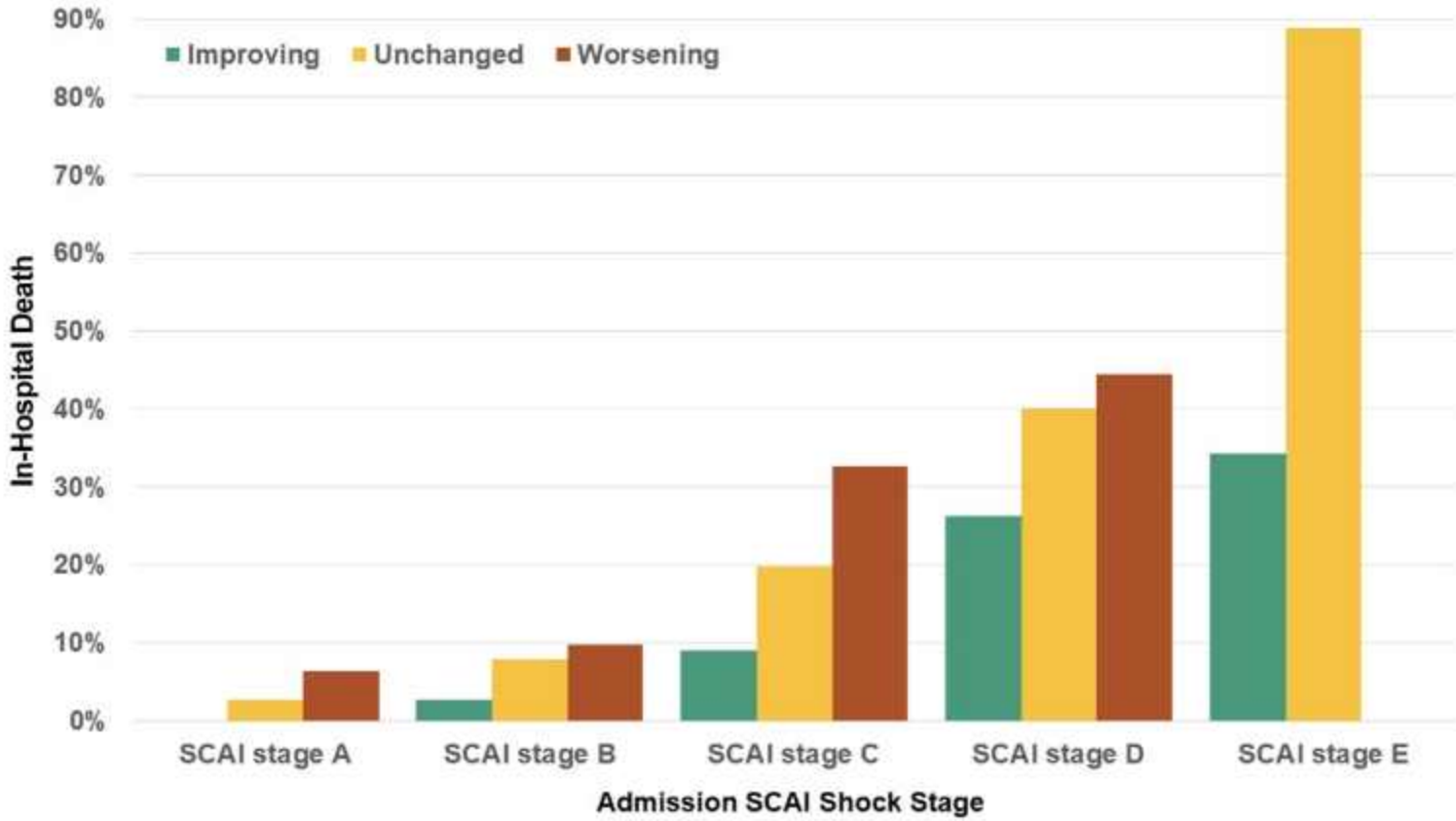
Time Matters: Revascularization in CS

SHOCK Trial, 1999

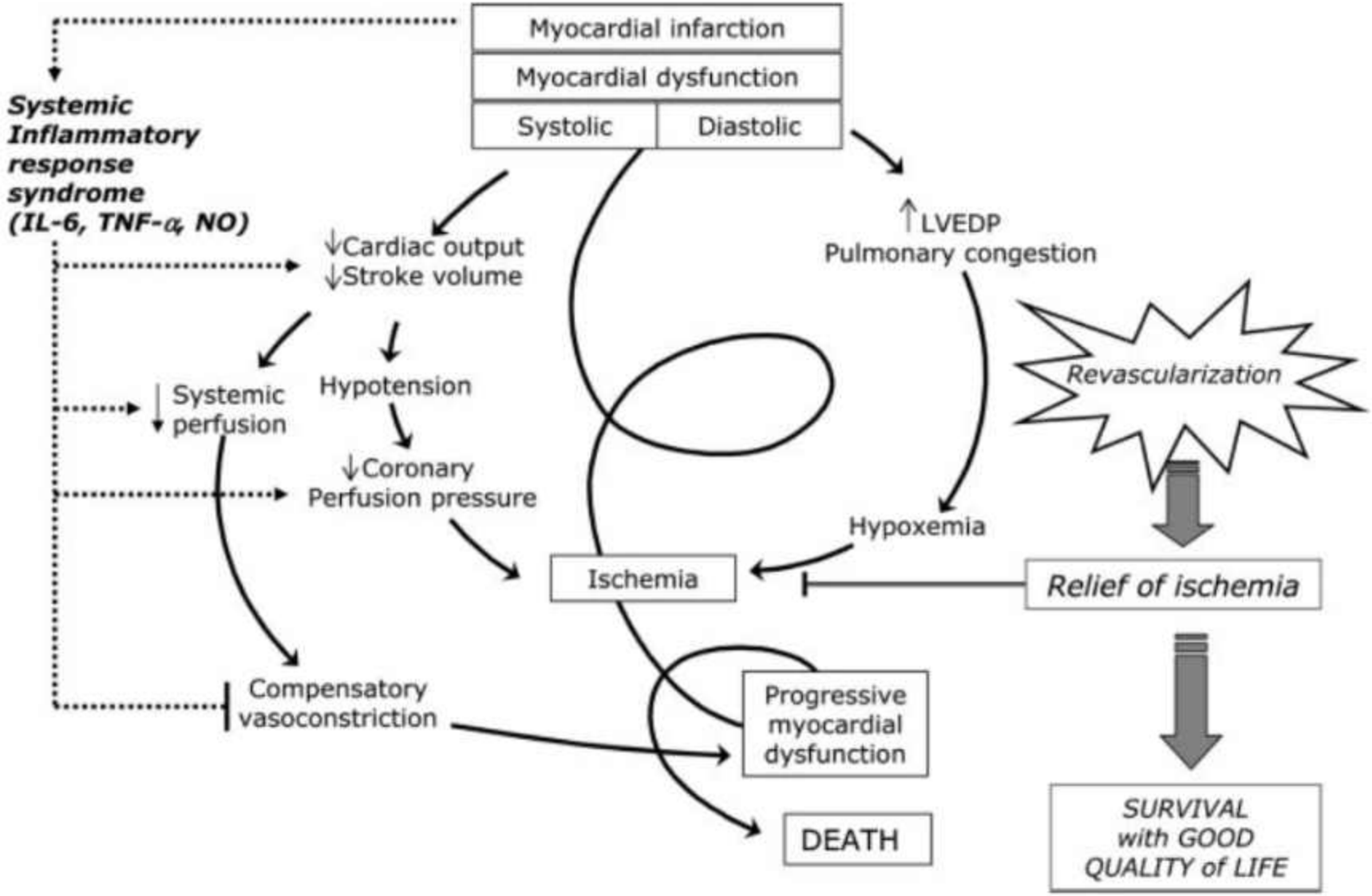


Hochman et al, SHOCK Trial, NEJM 1999

Time Matters: 24-hour SCAI Stage

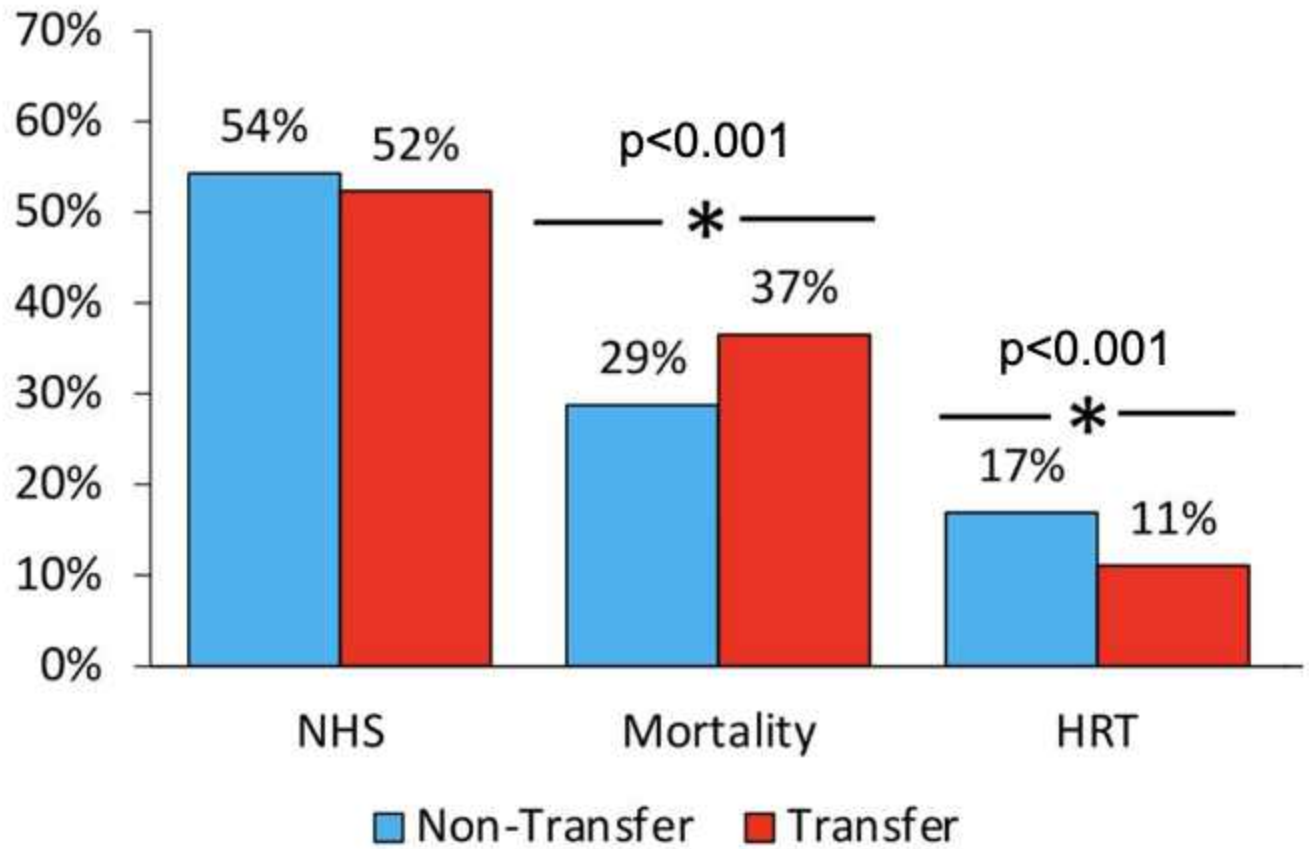


Jentzer et al. *JAHA*, 2023.



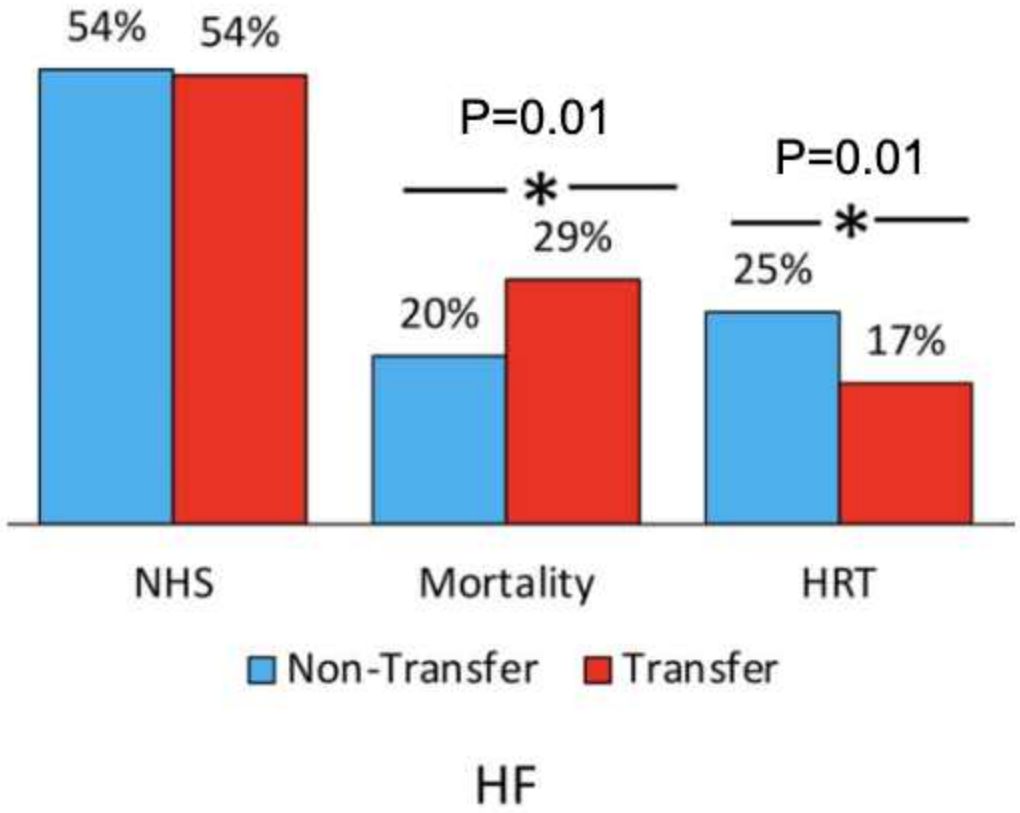
Reynolds HR, Hochman J. *Circulation*. 2008.

Time Matters: Transfers

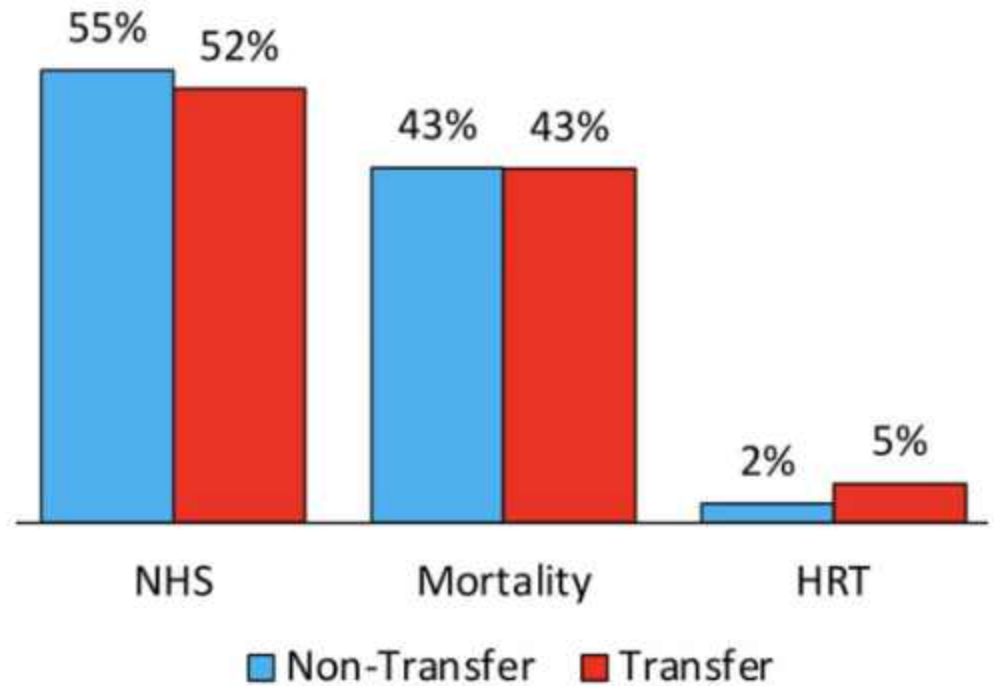


Garan et al. *JCF*. 2024.

Time Matters: Transfers



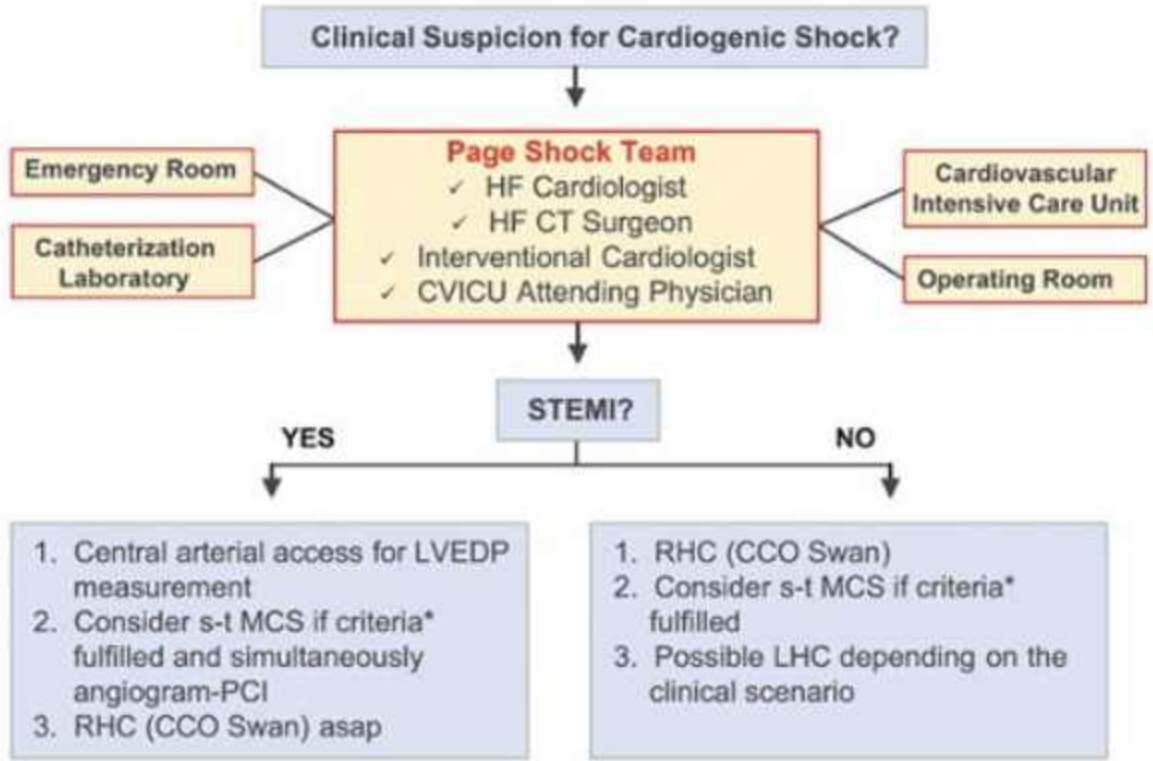
HF



AMI

Garan et al. *JCF*. 2024.

University of Utah Protocol



Taleb et al, Circulation 2019

University of Utah Protocol

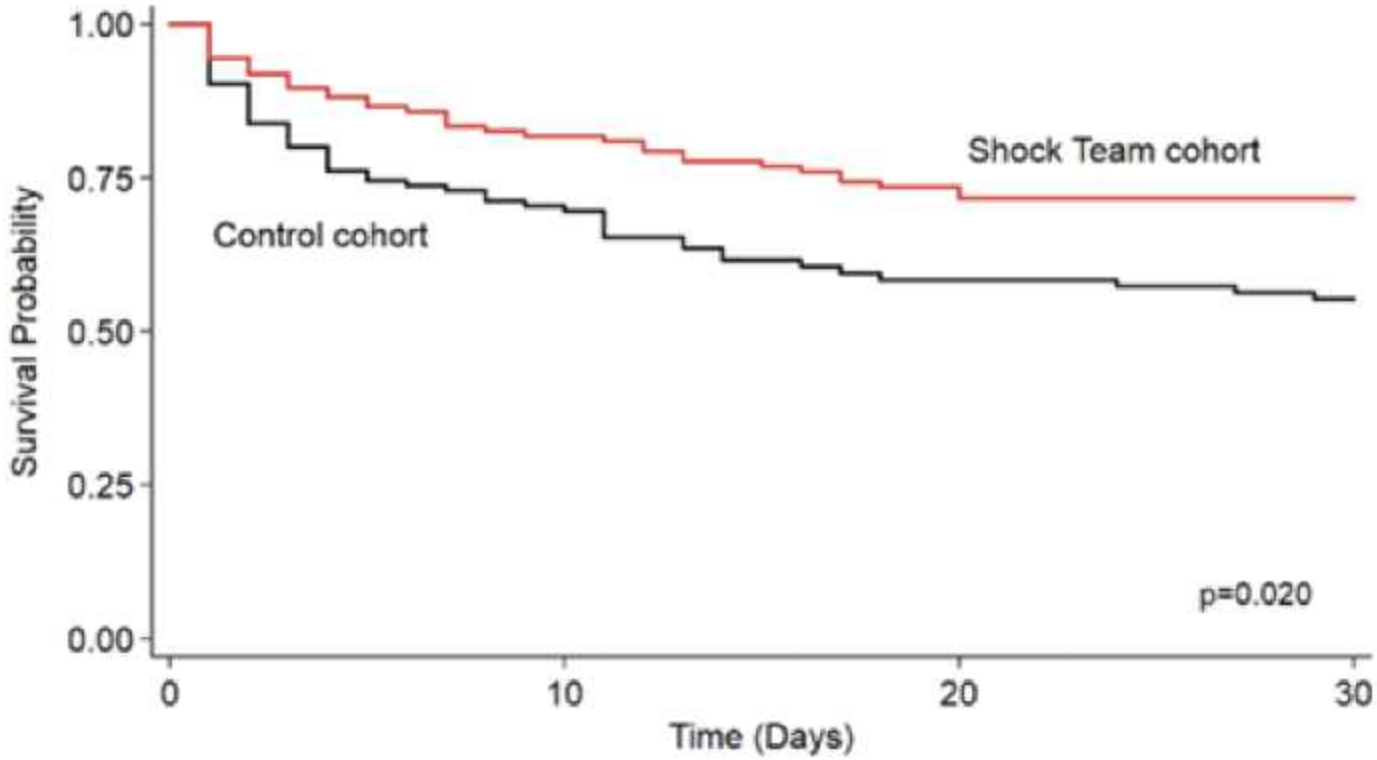
Consider short-term MCS (e.g., Impella, VA-ECMO, IABP, etc.) in case of:

- Low systemic blood pressure:
  - SBP < 90, MAP < 50 for > 30 minutes
  - Need for IV inotropes/vasopressors to maintain BP targets

- PLUS, one of the following
  - PCWP or LVEDP > 15 & Cardiac Index < 2.2
  - Pulmonary edema
  - Impaired end-organ dysfunction

Impact of a CS Team—Utah Study

- Aim
  - Compare CS outcomes before and after CS team
- Study population
  - 121 patients before 2015
  - 123 patients from 2015-2018 after CS team started
  - All received tMCS
- Outcome
  - 30-day all-cause mortality

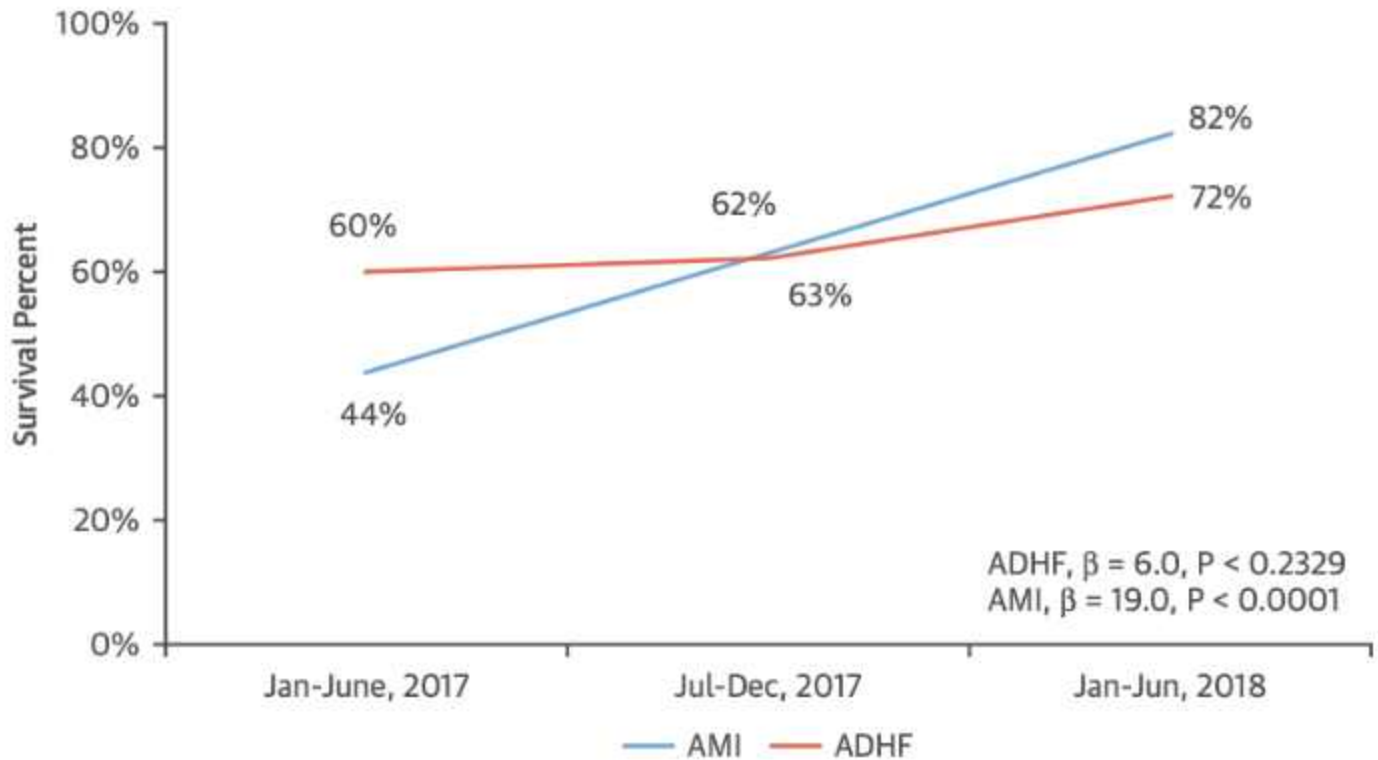


1399 weaned tMCS
3 survivors:
34 bridge to LVAD

HR 0.61 (0.41-0.93) with adjustment for markers of illness severity

Taleb, Circulation

INOVA Experience



Tehrani et al. *J Am Coll Cardiol*. 2019.

CS Team Impact—Multicenter

- Compare CS survival and management at centers with vs without CS team

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Management and Outcomes of Cardiogenic Shock in Cardiac ICUs With Versus Without Shock Teams

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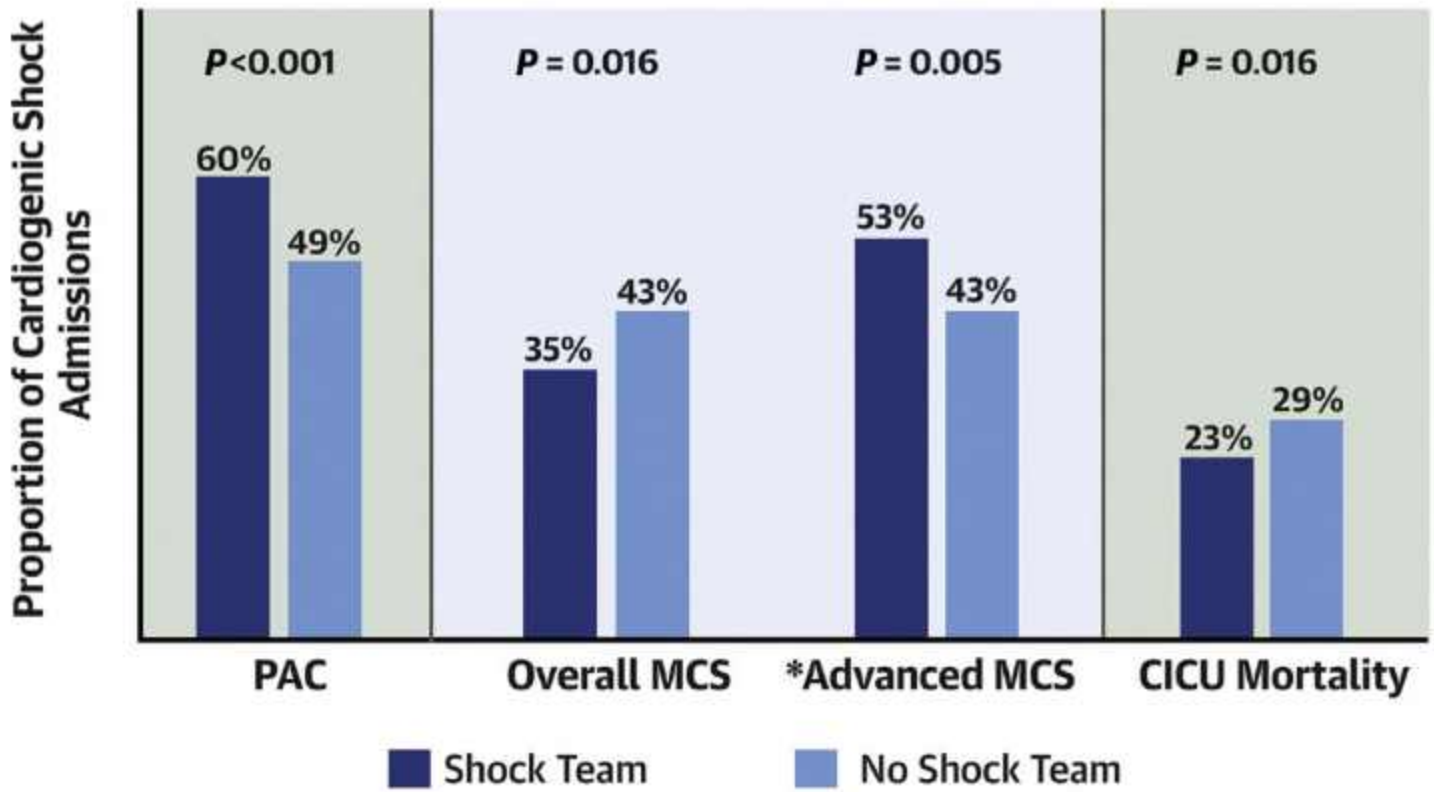
Papolos et al. *J Am Coll Cardiol*. 2021.

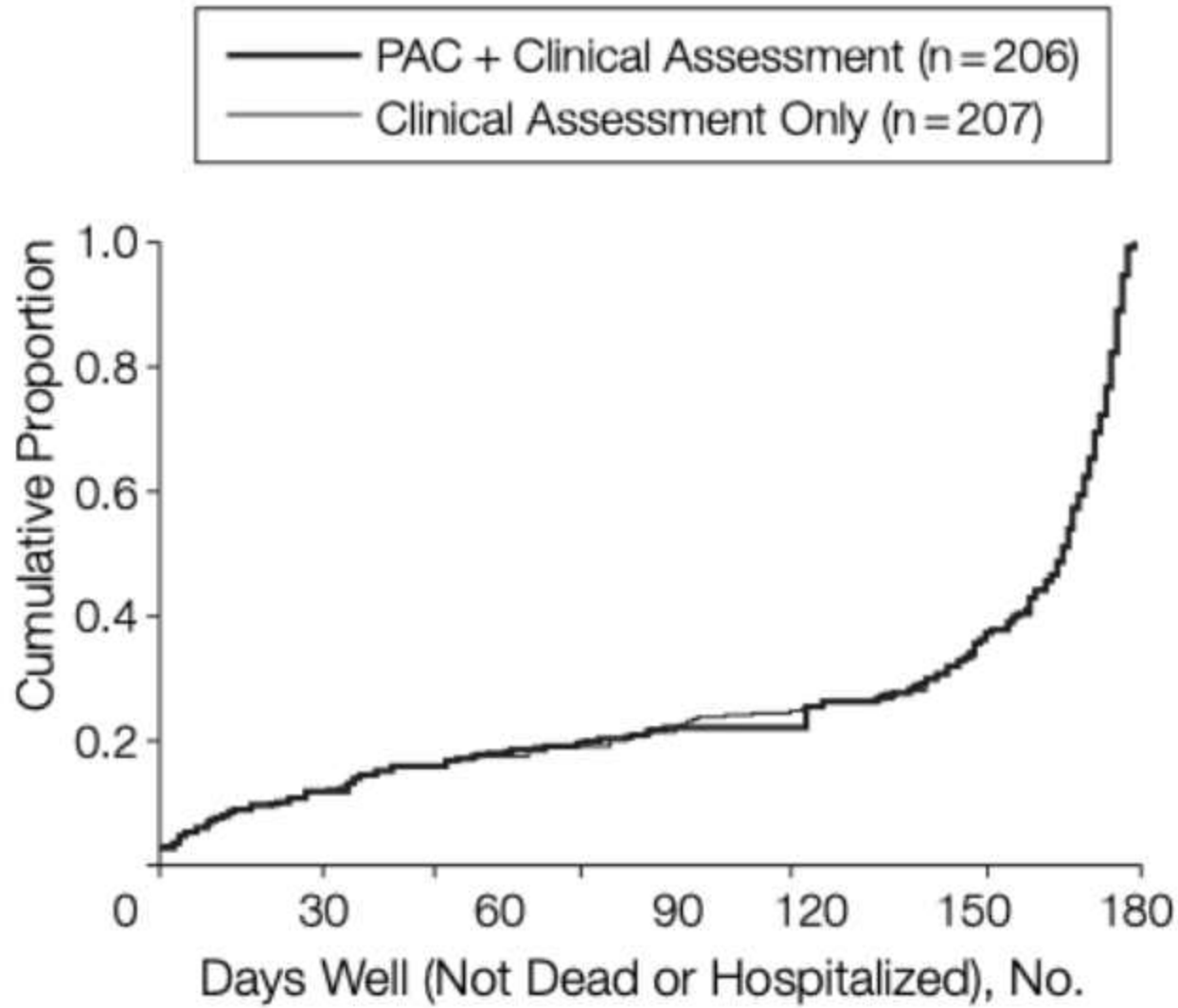
CS Team Impact



Papolos et al. *J Am Coll Cardiol*. 2021.

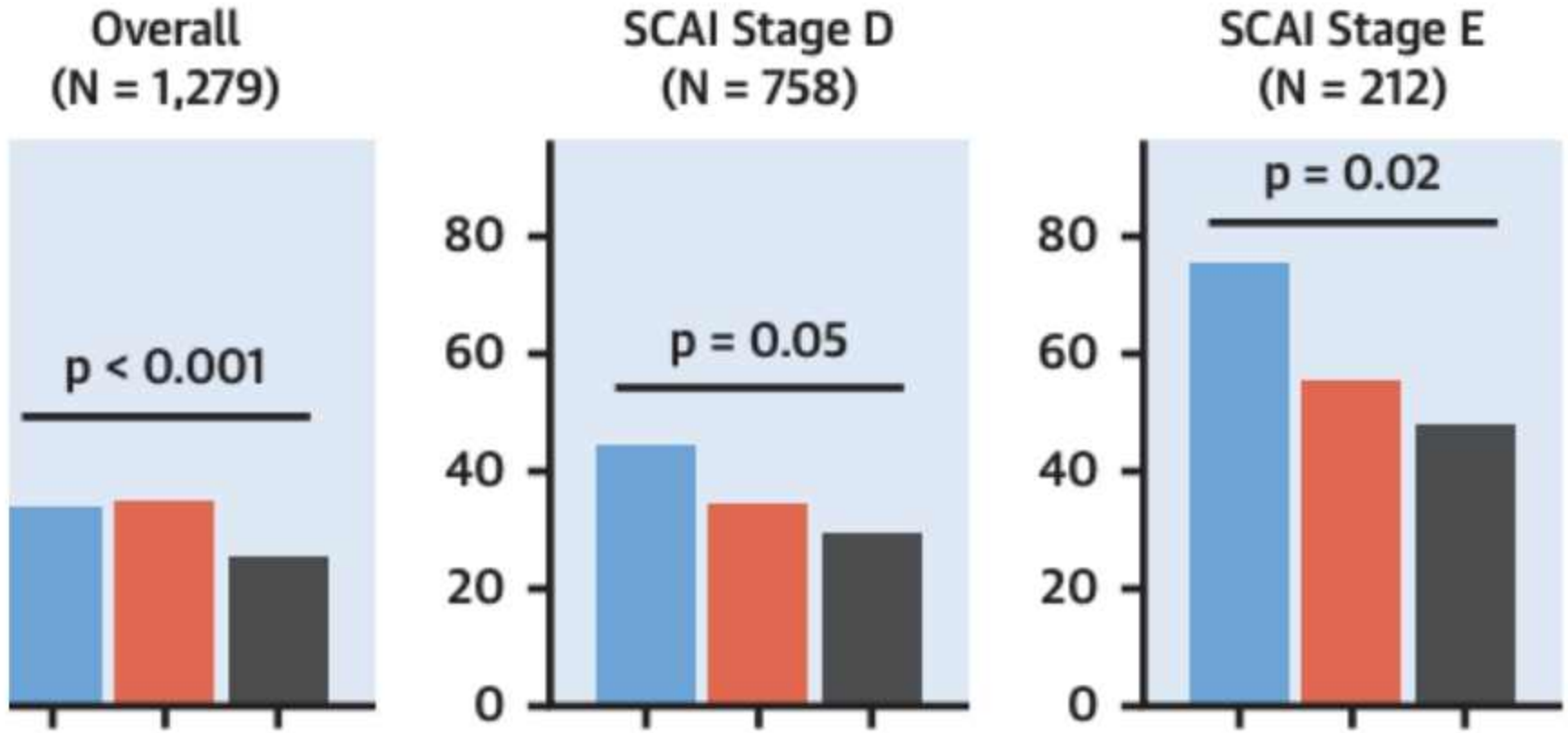
PA Catheters?

- ESCAPE Trial
  - Heart Failure



Binanay, Stevenson, et al. JAMA 2005

Invasive Hemodynamic Monitoring is Associated With Improved Survival in CS



Garan, *J Am Coll Cardiol*. 2020.

U.S. National Library of Medicine

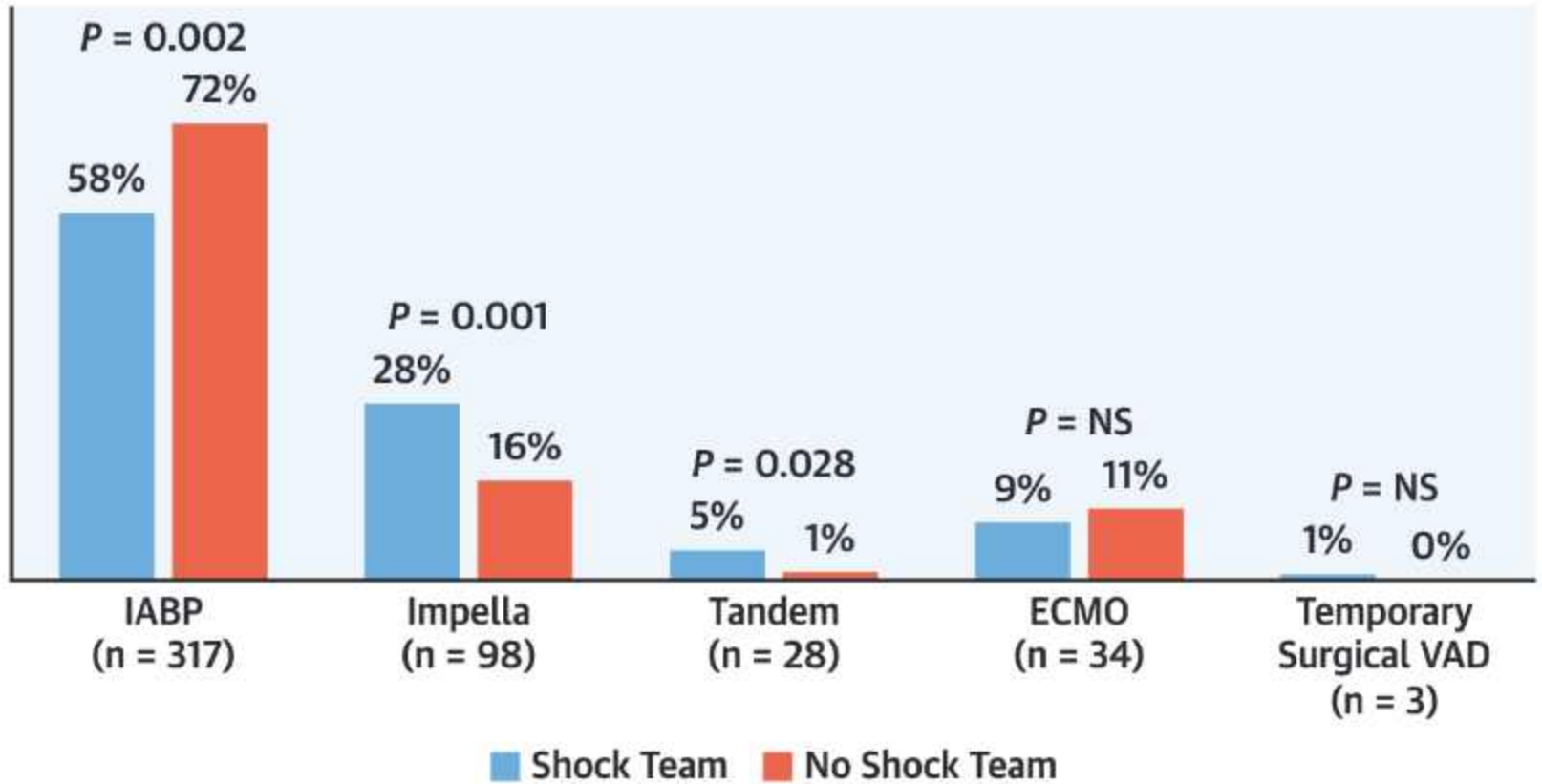
ClinicalTrials.gov

Find Studies

Home > Search Results > Study Record Detail

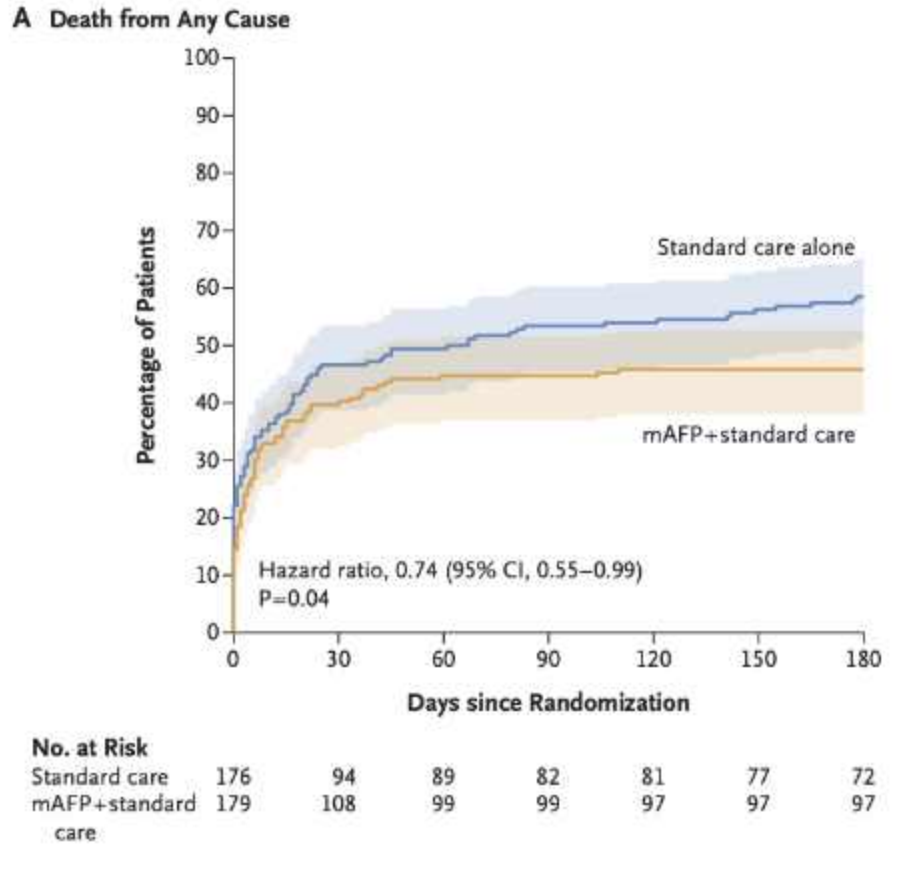
Pulmonary Artery Catheter in Cardiogenic Shock Trial (PACCS)

Advanced MCS



Papolos et al. *JACC*. 2021

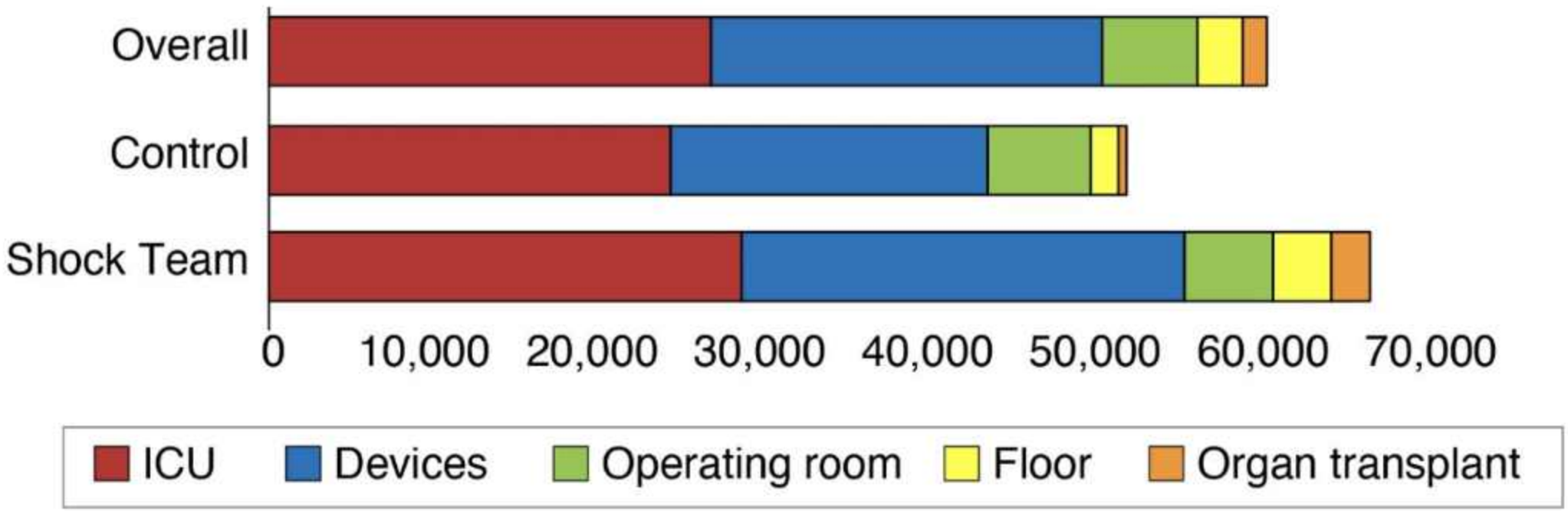
DanGer Shock Trial—Microaxial Flow Pump



Moller et al, NEJM, 2024

Cost Effectiveness?

Cost of a CS Team



Cost Effectiveness of a CS Team

- Incremental cost-effectiveness (ICER)
  - (i.e., cost/incremental survival benefit)

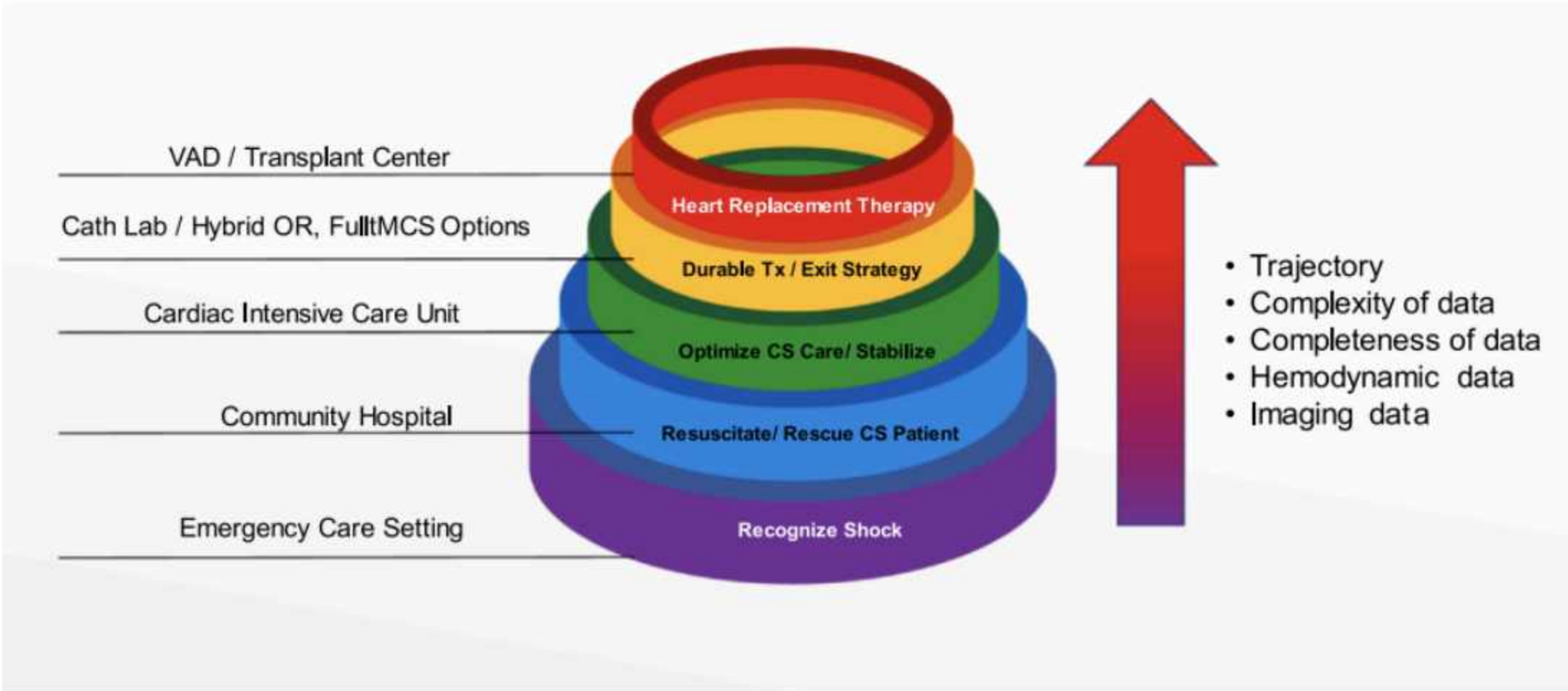
- $102,088 per QALY compared to standard of care
- Below the US “accepted” cutoff of $150,000

Pending publication

CS Team Challenges

- Providing consistent, reproducible response 24/7
- Defining optimal organizational structure
- Improving communication
- Equity of workload and reimbursement
- Minimize sense of lost autonomy
- Administration buy-in
- **Not all hospitals can/should operate CS teams**

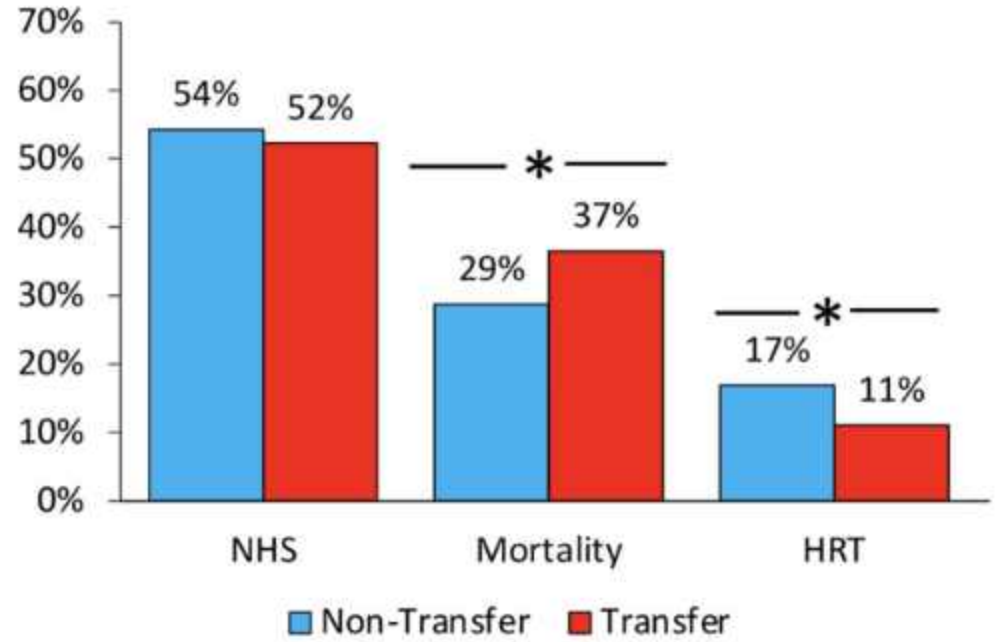
Circles of Cardiogenic Shock Care

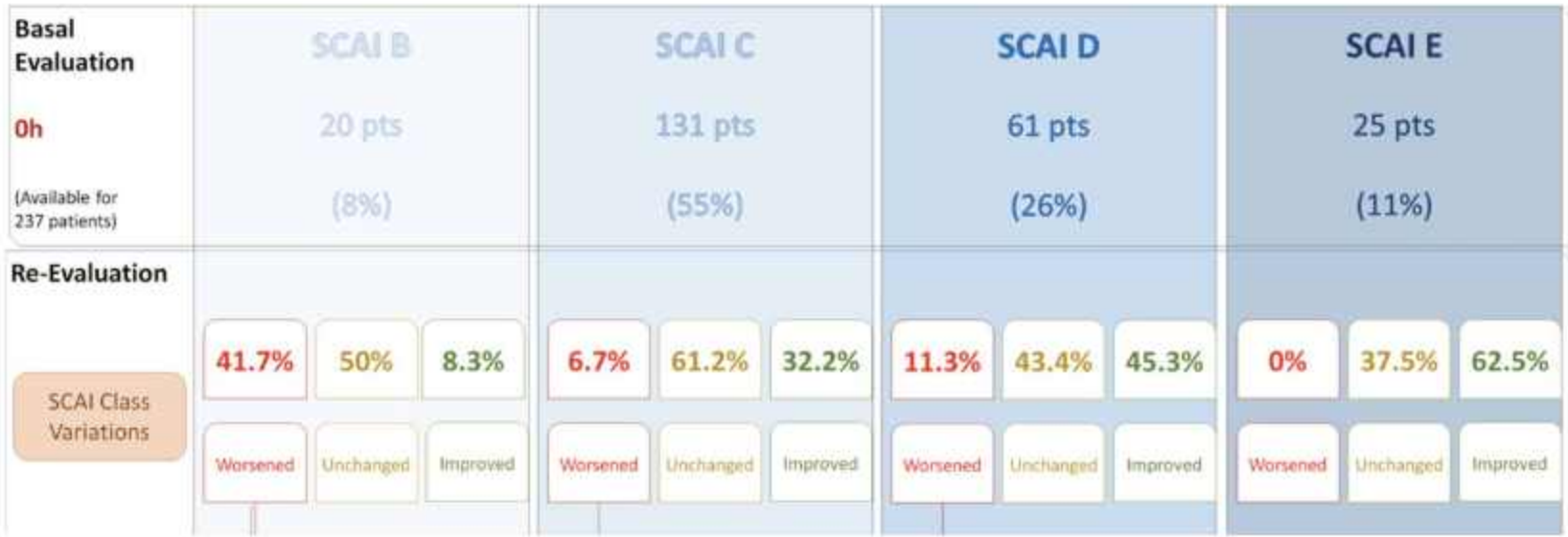


Baran et al. *JHLT*. 2023.

Rural Hospital Needs

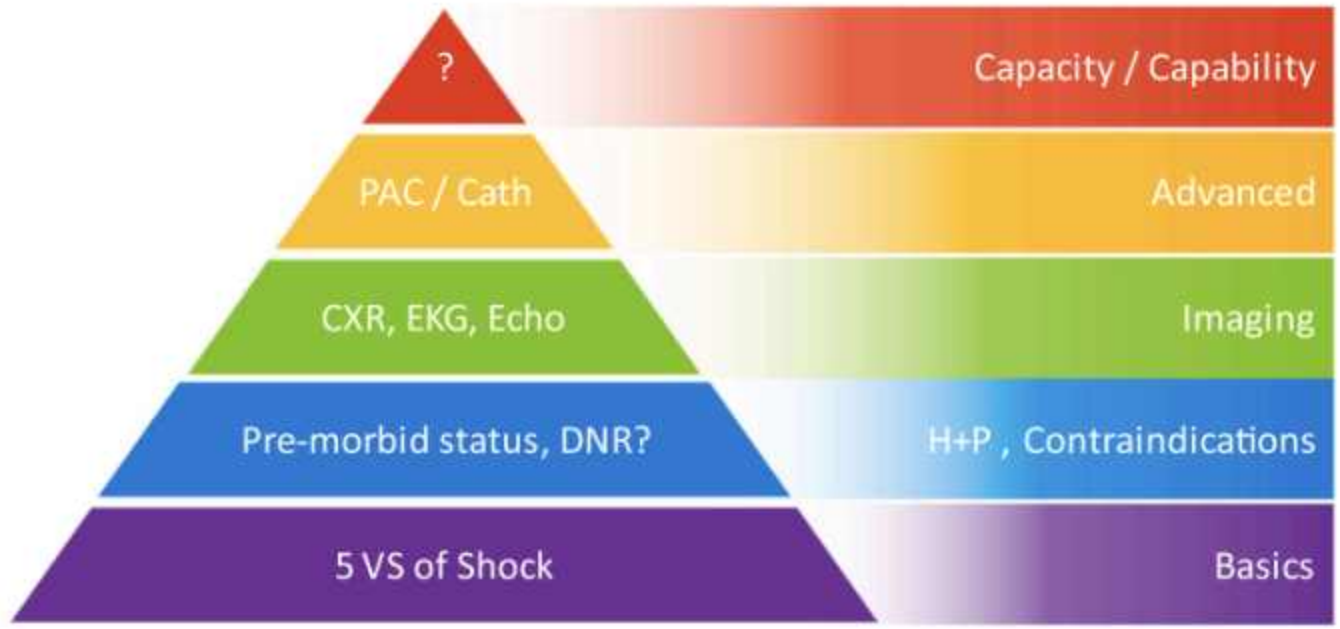
- Rapid triage of “stay” vs “transfer”
  - Time remains essential
  - Regional CS teams?





Garan et al. JCF. 2024.

Pyramid of Shock Transfer Information Exchange



5 vital signs of shock : Blood pressure, heart rate, assessment of oxygenation, lactate and urine output

Standardized templates?

Baran et al. *JHLT*. 2023.

Remaining Questions and Future Directions

- Extending to less resourced hospital systems/regions?
  - Volume breakpoint for cost effectiveness
    - What resources are existing
    - What resources should be added
  - “Regional” shock teams
  - Levels of CS care
- Optimal CS team role?
  - Intake only vs daily/twice daily rounding
  - Available resources/cost effectiveness

Future Directions: Research

Need for a Cardiogenic Shock Team Collaborative—Promoting a Team-Based Model of Care to Improve Outcomes and Identify Best Practices

Balimkiz Senman, Jacob C. Jentzer, Christopher F. Barnett, Jason A. Bartos, David D. Berg, Sharon Chih, Stavros G. Drakos, David M. Dudzinski, Andrea Elliott, Ann Gage, James M. Horowitz, P. Elliott Miller, Shashank S. Sinha, Behnam N. Tehrani, Eugene Yuriditsky, Saraschandra Vallabhajosyula and Jason N. Katz

Senman et al. *JAHA*. 2024.

Thank you CHFS and HFSA!

HENRY FORD HEALTH
Heart & Vascular

Medical Management of Patients on Durable MCS

Jennifer Cowger, MD, MS

Section Head, Advanced Heart Failure, Transplant and MCS
Member of Shock, Structural, Amyloid, Sarcoid and HCM Programs

Henry Ford Health
Detroit, Michigan, USA

Disclosures as of May 2024……

- Abbott: Consultant (HeartMate 3, Tendyne valve, Cephea valve), P&P Committee for MOMENTUM 3 trial, National PI (Team HF), speaker
- Medtronic: Consultant (HVAD), National PI of the DT-PAS study
- CH Biomedical: Steering Committee for upcoming trial.
- Procyrion: Consultant (Aortix), stock options
- Endotronix: Consultant (Cordella Steering Committee)- unpaid
- BiVACOR: DSMB
- Berlin Excor: DSBM
- Nuwellis: Consultant (Steering committee), unpaid
- CorWave: Consultant, unpaid
- Zoll: Speaker for fellows' conferences
- Astra Zeneca: National steering committee for clinical trial

Learning Objectives…

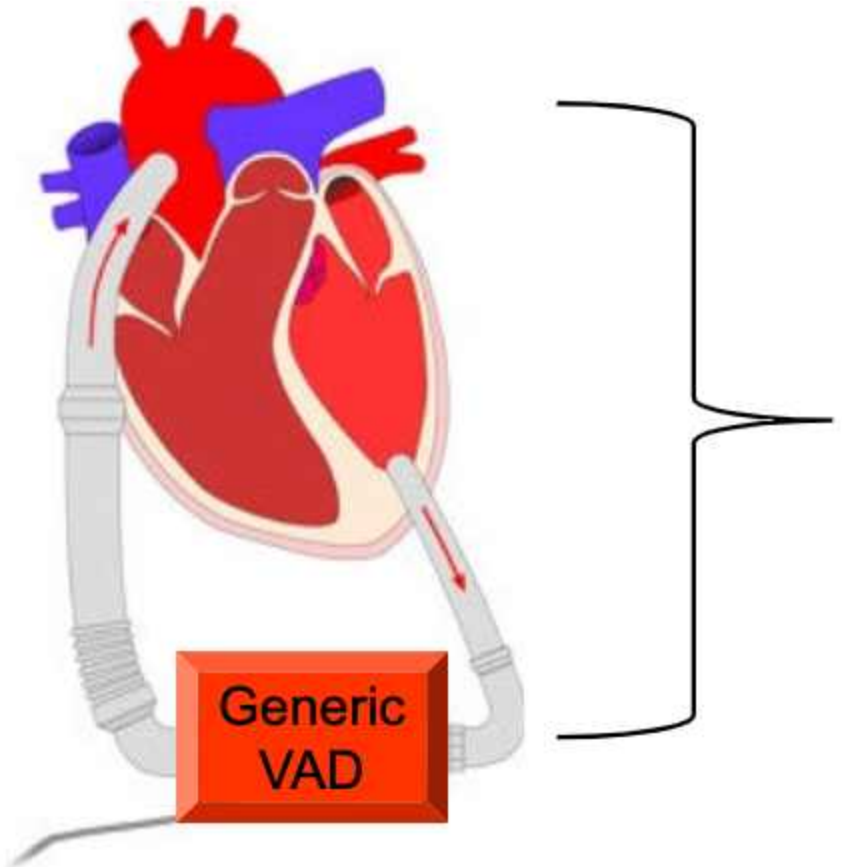
1) Interpret the hemodynamic status of patients supported with durable MCS.

2) Interpret the impact of continuous flow on normal physiologic function during durable MCS

3) Diagnose common medical complications associated with durable MCS

4) Apply treatment plans adapted for durable MCS supported patients.

Hypertension
Pressure-Flow Relationship

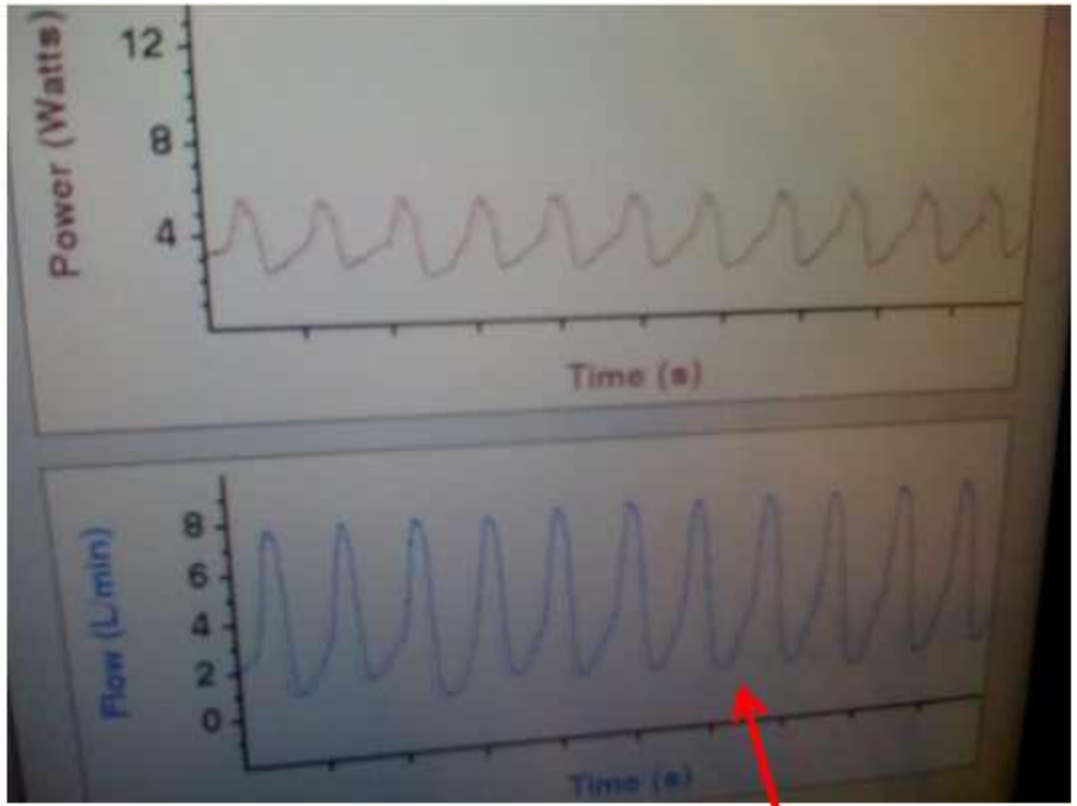


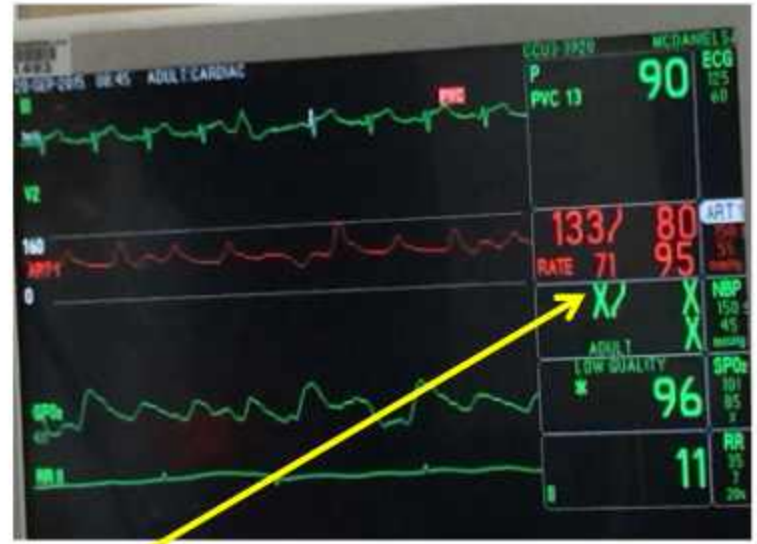
$$\text{Flow} \propto \text{rpm}$$

$$\text{Flow} \propto \frac{1}{\Delta P}$$

ΔP = differential (aka head) pressure between inflow and outflow

HTN: Affects Diastolic > Systolic Flow



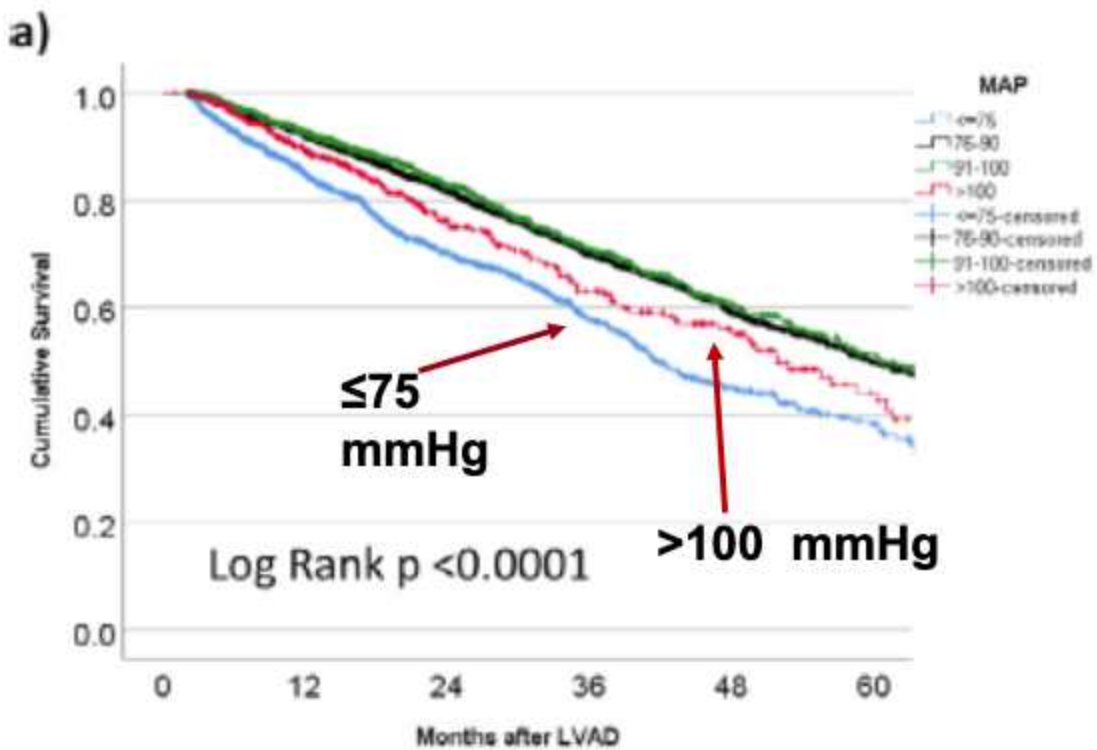


Flows near 0

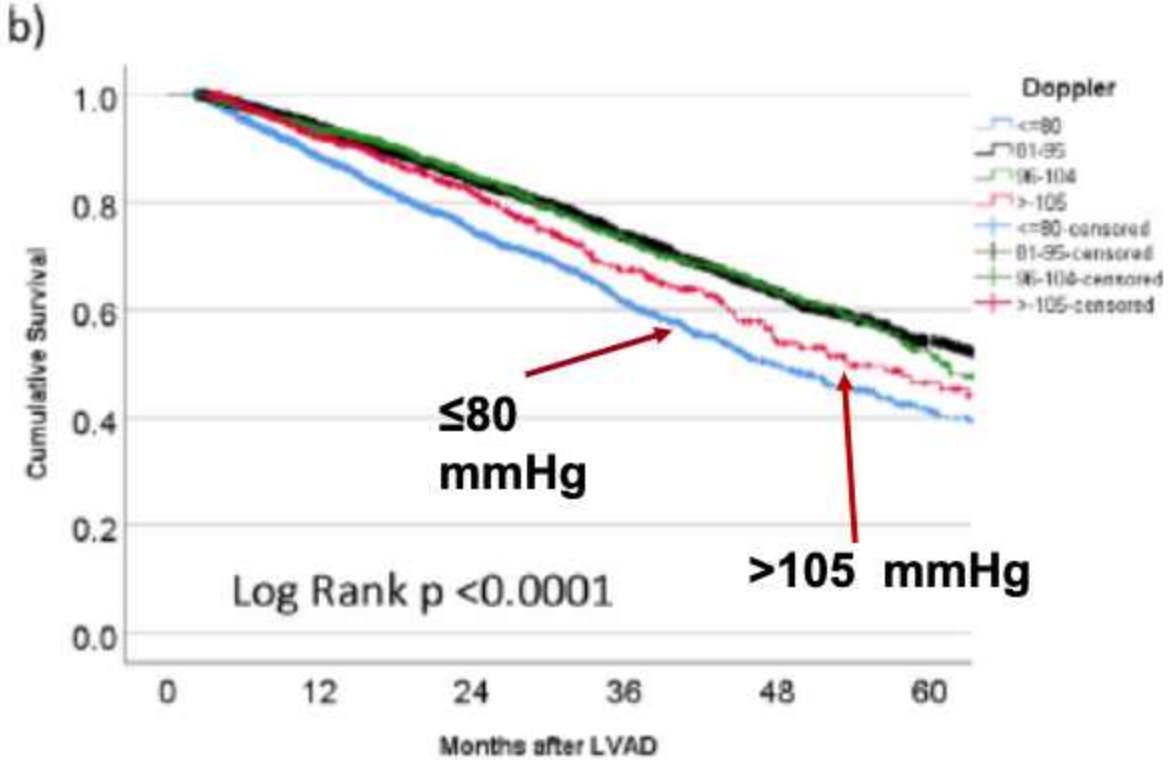
Intermacs- Average BP during LVAD support

N=16155 Operative Survivors

Survival by MAP



Survival by DOP



Cowger et al, J Heart Lung Transplant 2020;39:441–453

2023 ISHLT MCS Guidelines

Blood pressure monitoring for stroke mitigation	
Recommendations for BP control and monitoring in the early postoperative period: (Not addressed in 2013)	**Recommendations for BP control and monitoring in the early postoperative period:** Class I: 1. Arterial line monitoring is recommended early after LVAD implant to allow for accurate BP monitoring. Level of Evidence C. *(New)* Class IIa: 1. To reduce the risk of stroke in hospitalized patients, it is reasonable to target a mean arterial pressure 75-90 mmHg. Level of Evidence B. *(New)* Class III: 1. There are no data to support aggressive afterload reduction after LVAD implant. Excessive pharmacologic hypotension (MAP <75 mmHg) should be avoided. Level of Evidence C. *(New)*

The 2023 International Society for Heart and Lung Transplantation Guidelines for Mechanical Circulatory Support: A 10- Year Update

Diyar Saeed, MD, PhD,[1] David Feldman, MD, PhD,[2] Aly El Banayosy, MD,[3]

Best Practices for Hypertension Management on LVAD

Stable LVAD implant
(off inotropes, adequately clinically diuresed)

↓

Heart failure signs, symptoms or elevated biomarkers (NTproBNP)

NO ↙ ↘ YES

Maintain MAP 70-90 mmHg

- Add / maximize RAASi* if K ≤5.5 mEq/L & GFR ≥30 mL/min/ 1.73 m² *(substitute with hydralazine / isosorbide dinitrate if K ≥5.5 mEq/L & GFR ≤30 mL/min/ 1.73 m²)*
- Add / maximize BB
- Add / maximize MRA if K ≤5.5 mEq/L & GFR ≥30 mL/min/ 1.73 m²
- Add SGLT2i if GFR ≥30 mL/min/ 1.73 m²

Invasive hemodynamic and echocardiographic optimization of LVAD speed:

RAP ≤8-10 mmHg; PCWP ≤15 mmHg; CI ≥2.4 L/min/m²

Midline septum; MR ≤1, Doppler E/E' ≤14

↓

Maintain MAP 70-90 mmHg

- Add/ maximize RAASi* if K ≤5.5 mEq/L & GFR ≥30 mL/min/ 1.73 m²
- Add / maximize BB
- Add / maximize MRA if K ≤5.5 mEq/L & GFR ≥30 mL/min/ 1.73 m²
- Add SGLT2i if GFR ≥30 mL/min/ 1.73 m²

↓

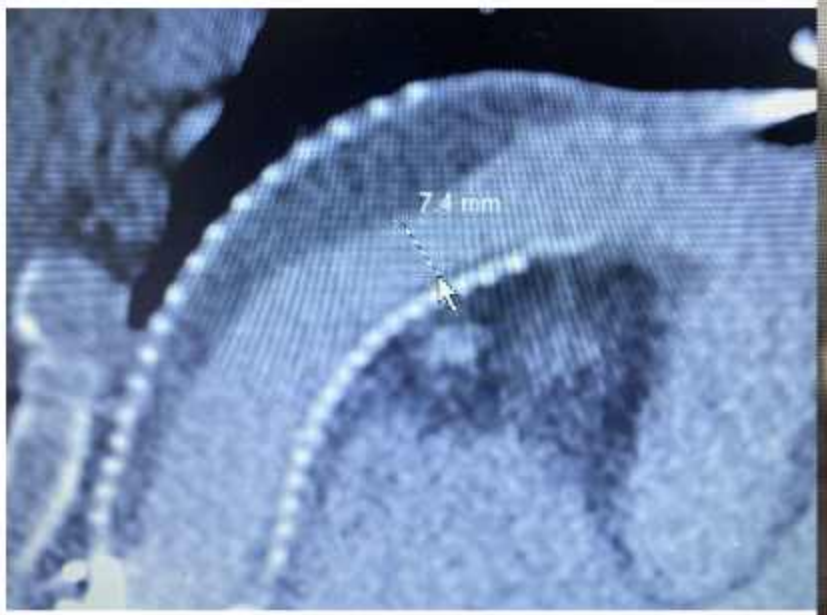
MAP ≥90 mmHg

↓ YES

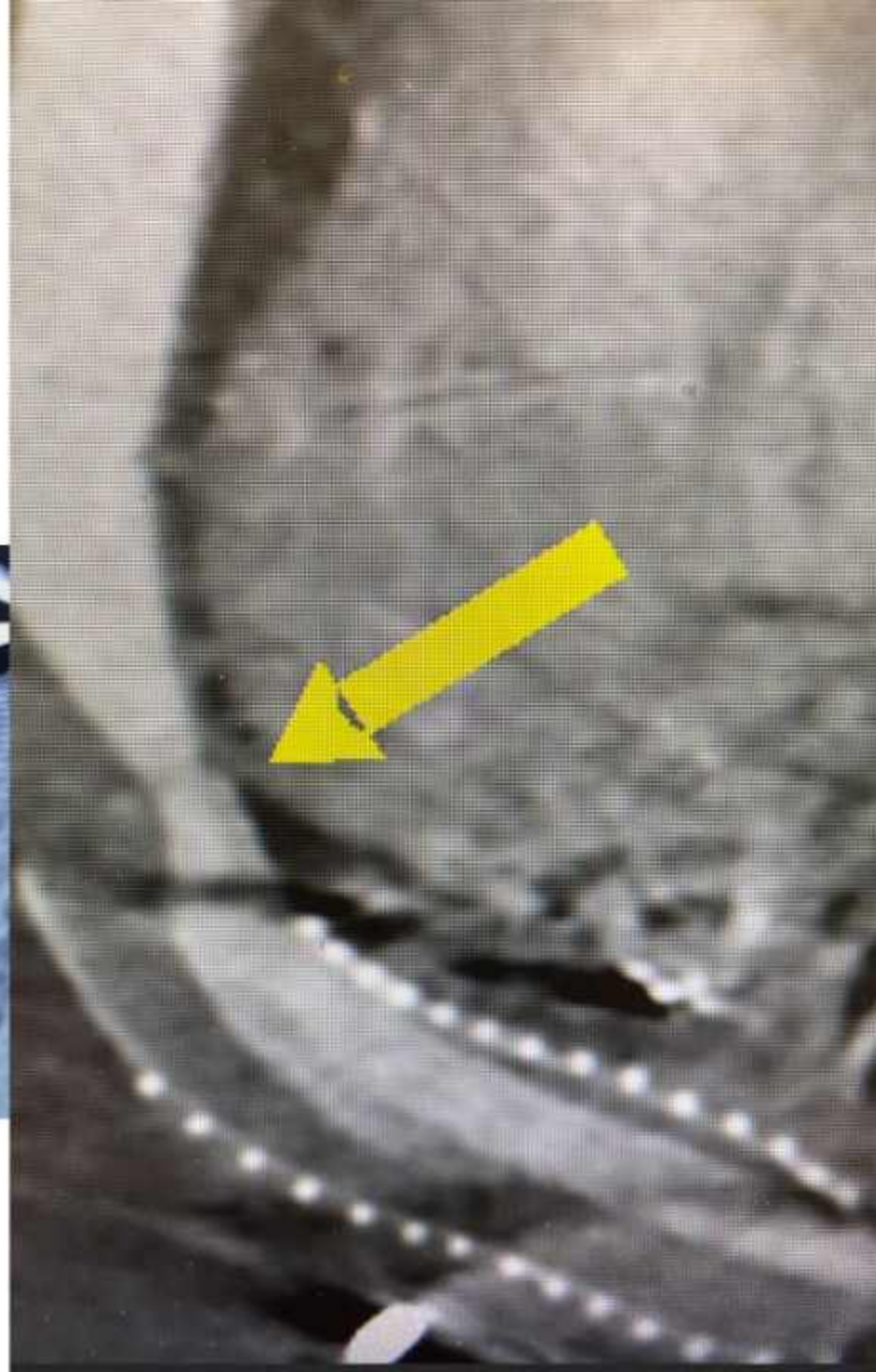
Add / maximize hydralazine / isosorbide dinitrate if Black race or dihydropyridine calcium channel blocker

Trachtenberg, J. Cardiac Fail 2023;29:479-502

Abbott/Thoratec Corp. Recalls HeartMate II and HeartMate 3 Left Ventricular Assist System (LVAS) due to Long-term Buildup Causing an Obstruction



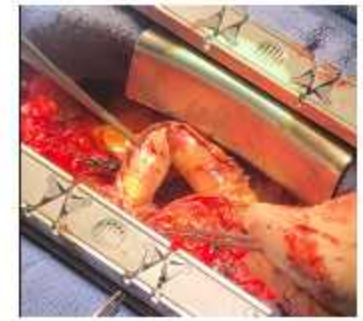
https://www.fda.gov/medical-devices/

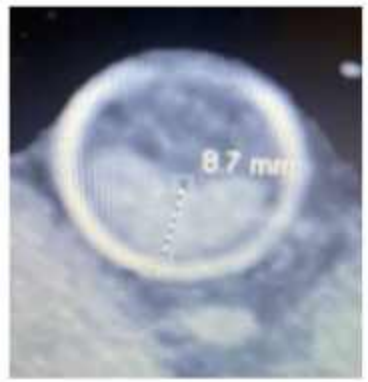


Outflow Occlusion

Etiology

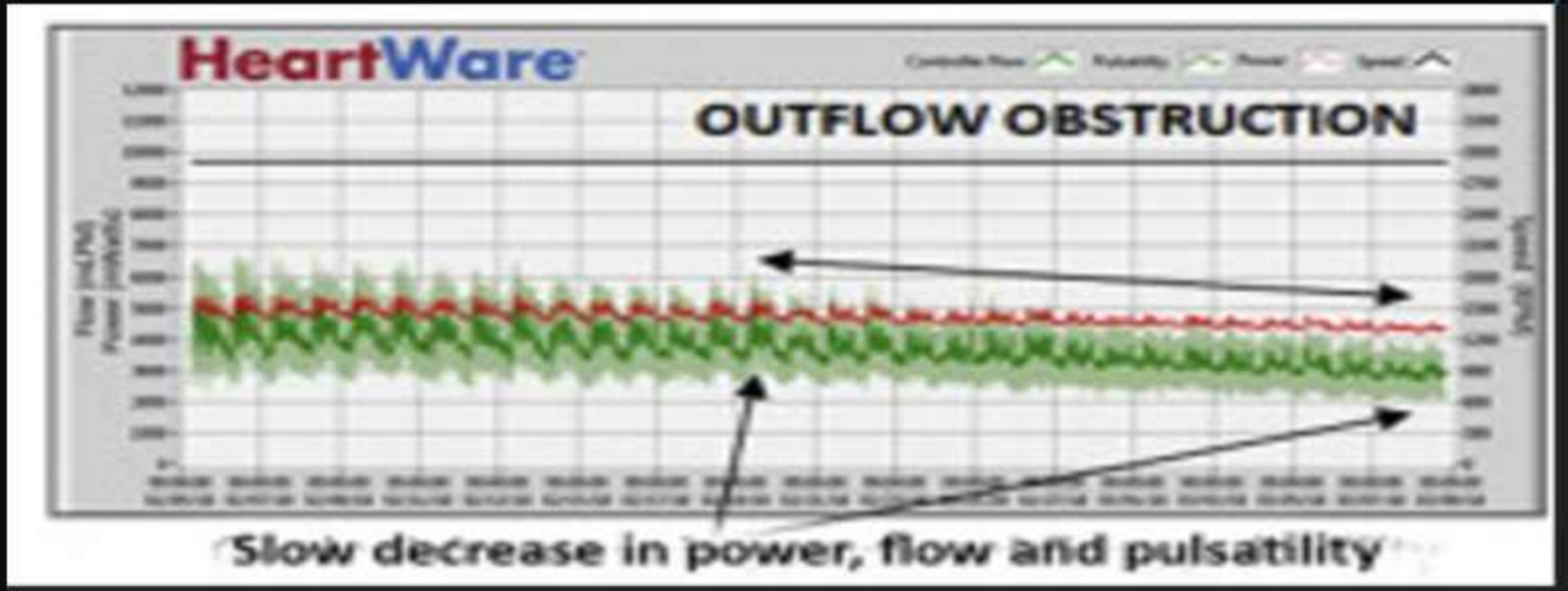
- Occlusion within the outflow (protein/clot)
- Kinking of the outflow from long graft
- Twisting of the outflow
- Extrinsic compression of the outflow from protein





Signs of Outflow Occlusion

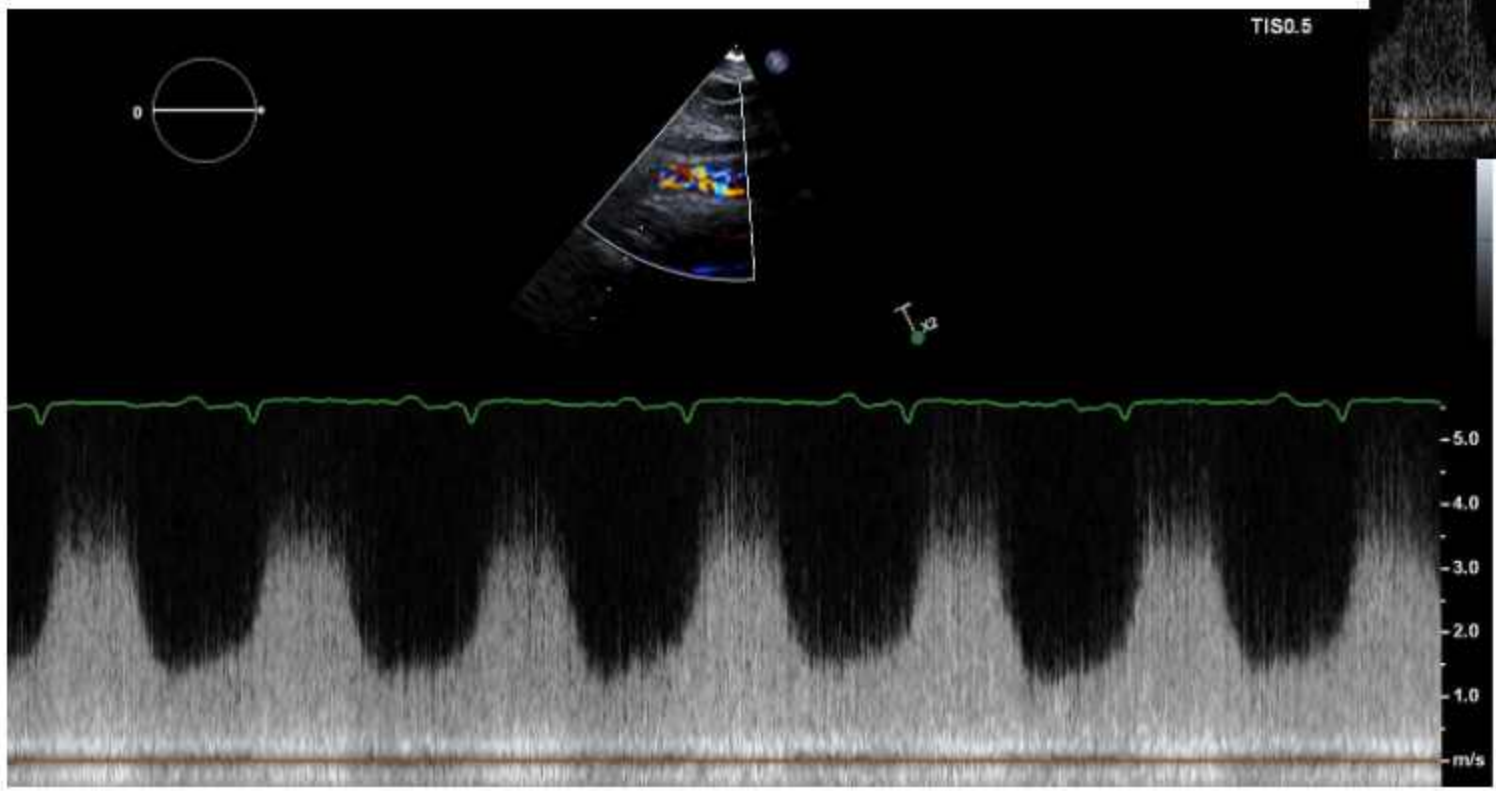
- Recurrent HF symptoms, worsening MR, LV dilation
- **Low flow** alarms despite adequate volume resuscitation
- ↓flows abruptly or (more commonly) slowly over time
- ↓power consumption abruptly <<< slowly over time

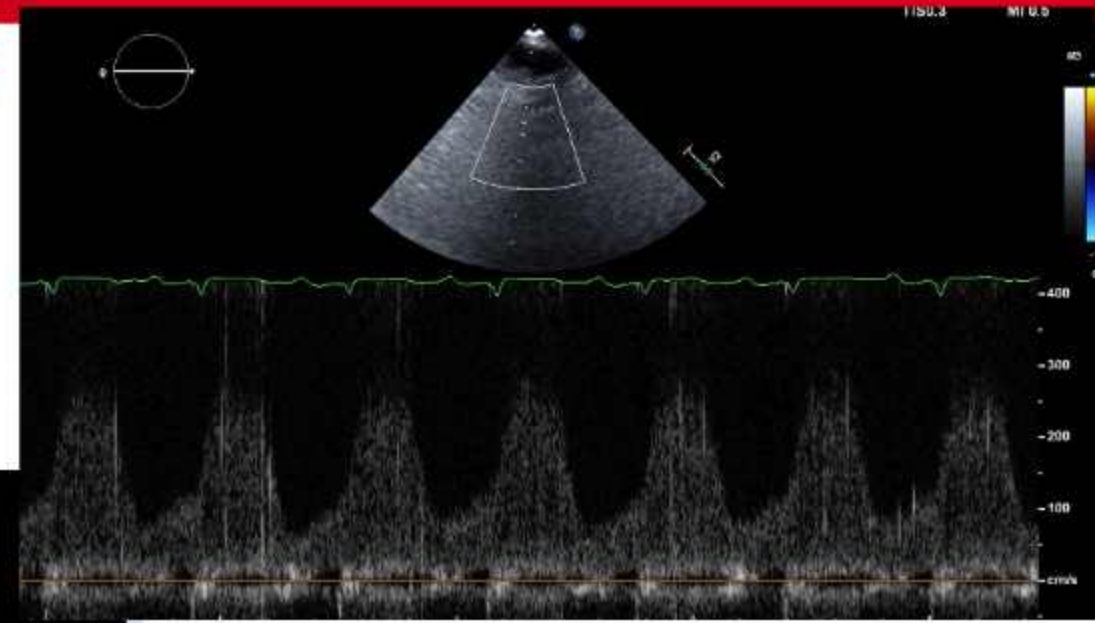


Hayward, J Thorac Cardiovasc Surg 2022;164:1120-1137

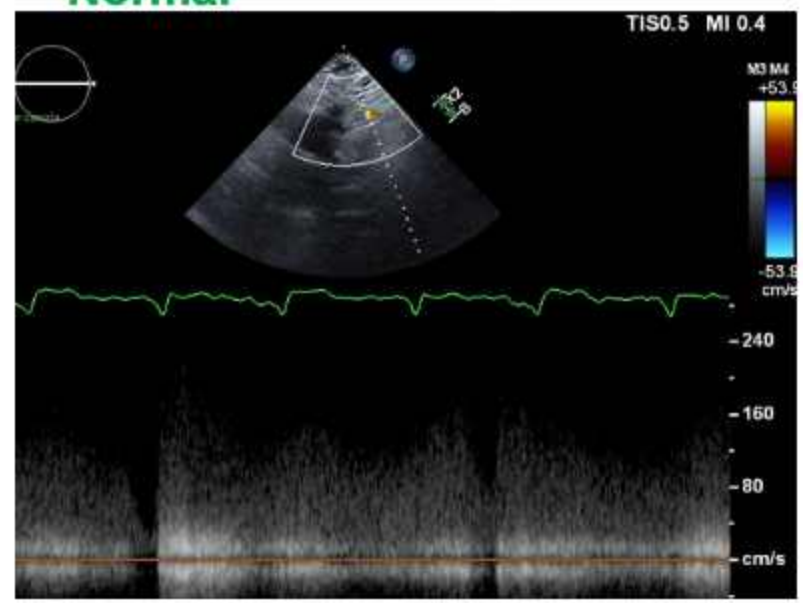
Doppler interrogation of LVAD outflow cannula at aorta

High outflow Doppler V in pt with known EOGO



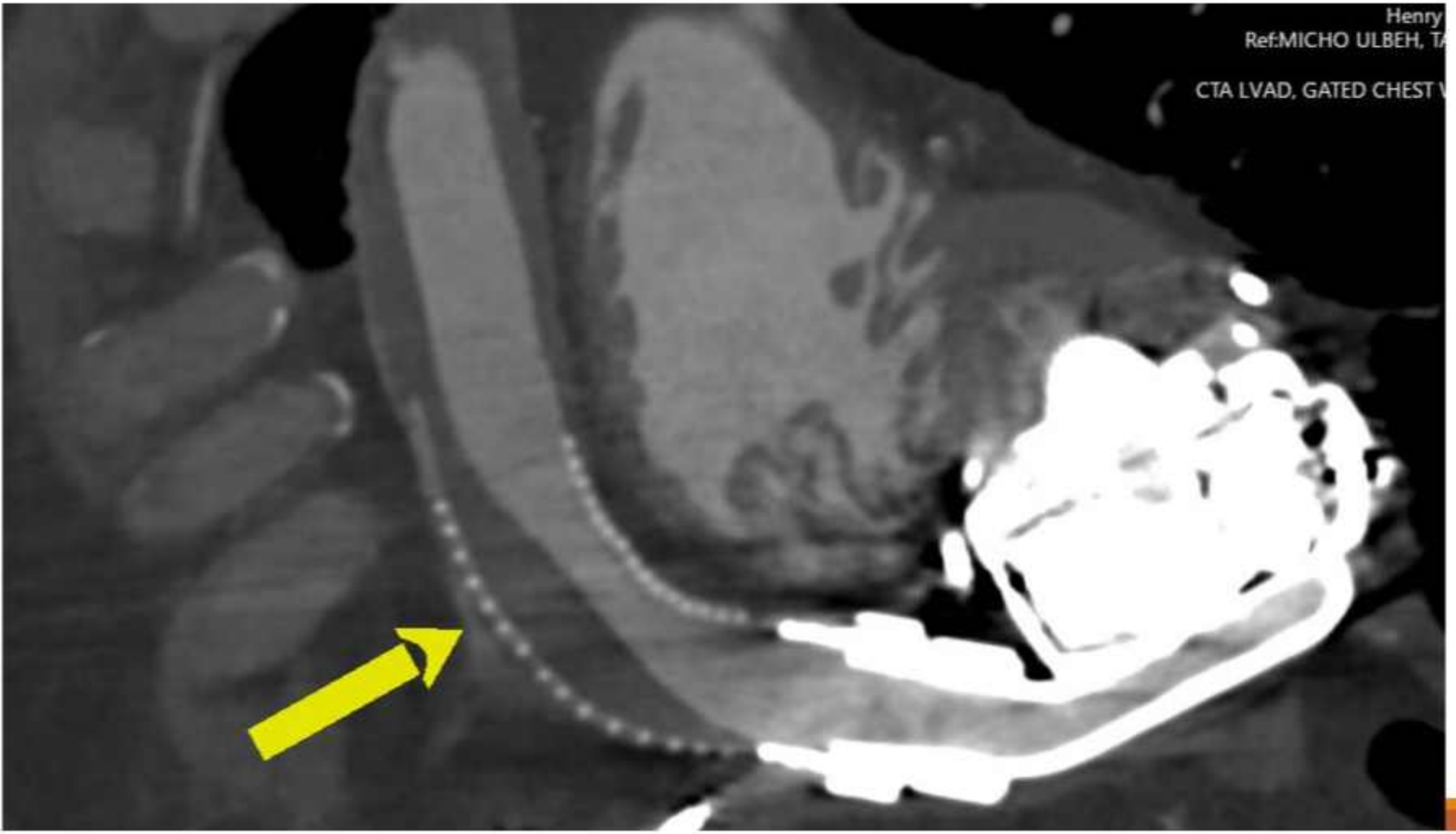


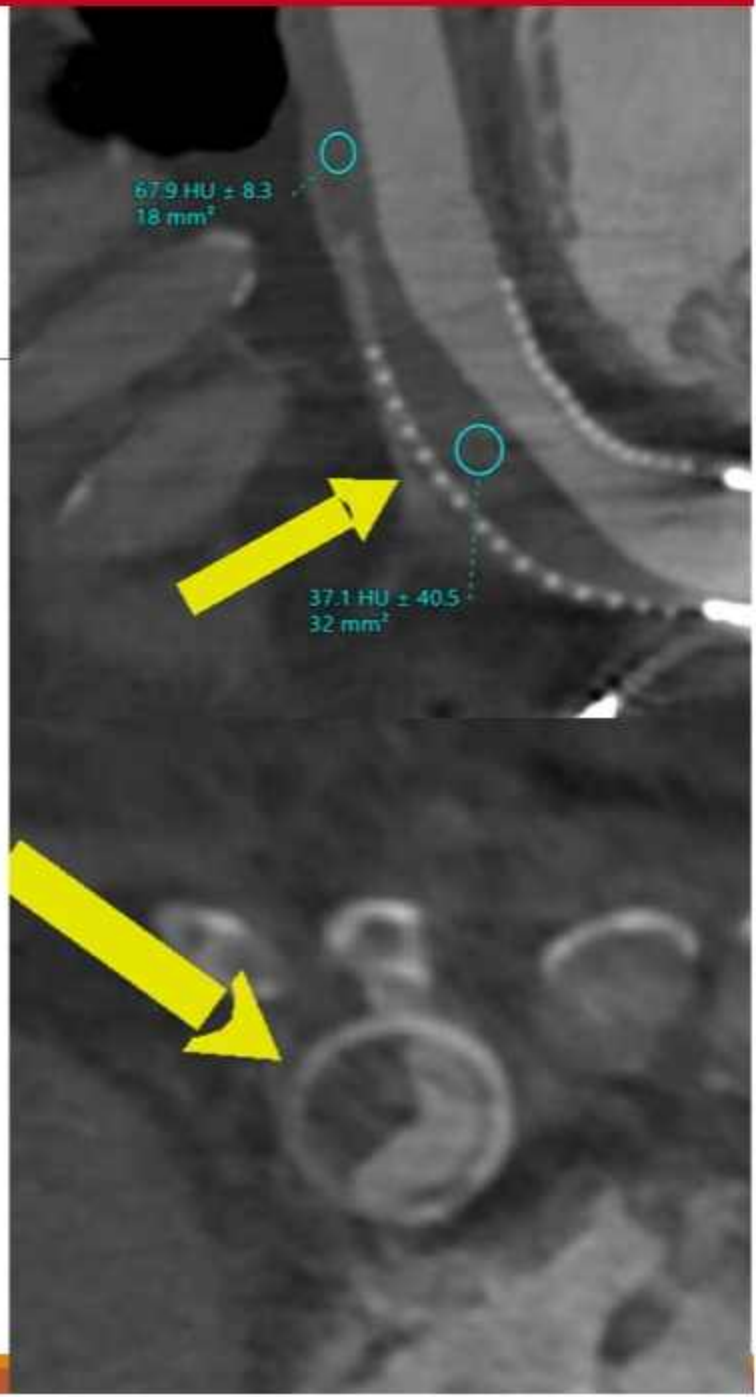
Normal

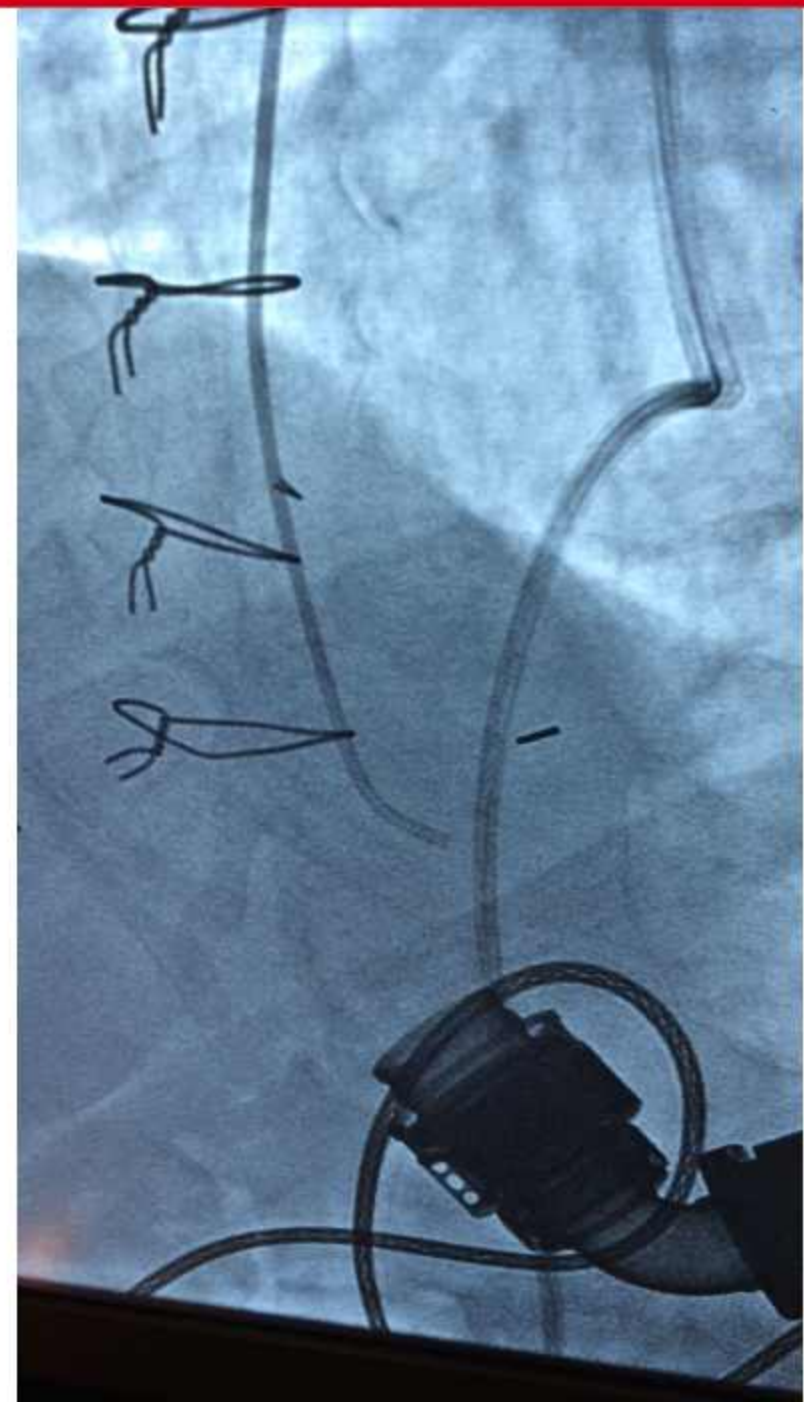


Outflow Canula

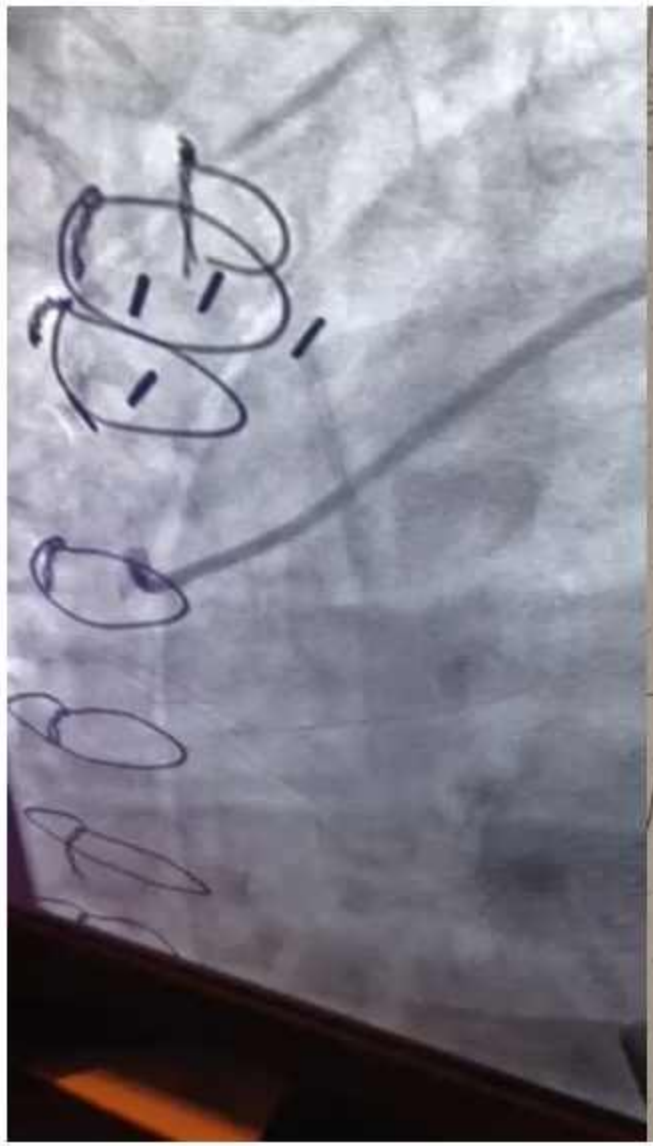
-Narrowing at bend relief with approximately 50% stenosis secondary eccentric protrusion.

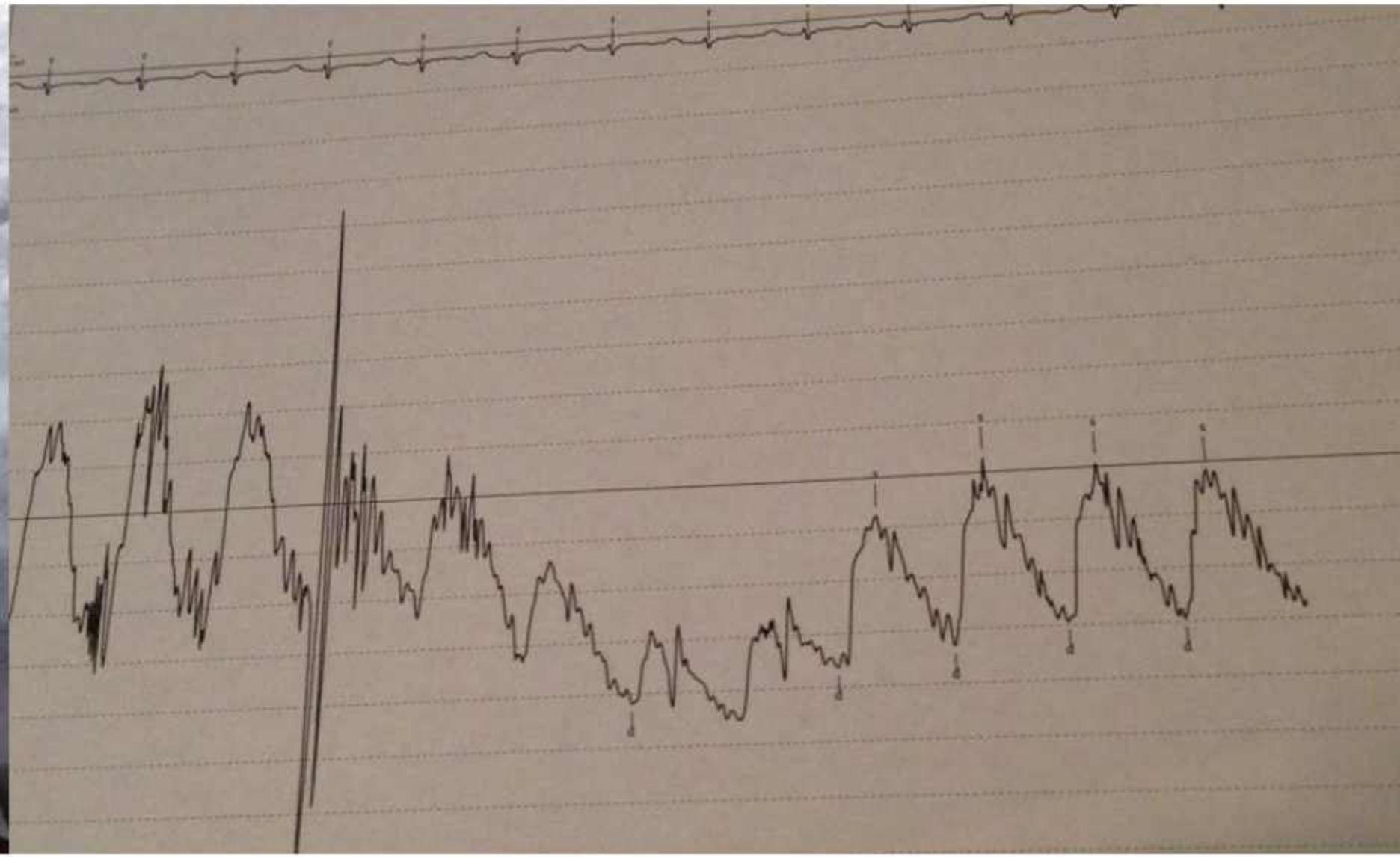


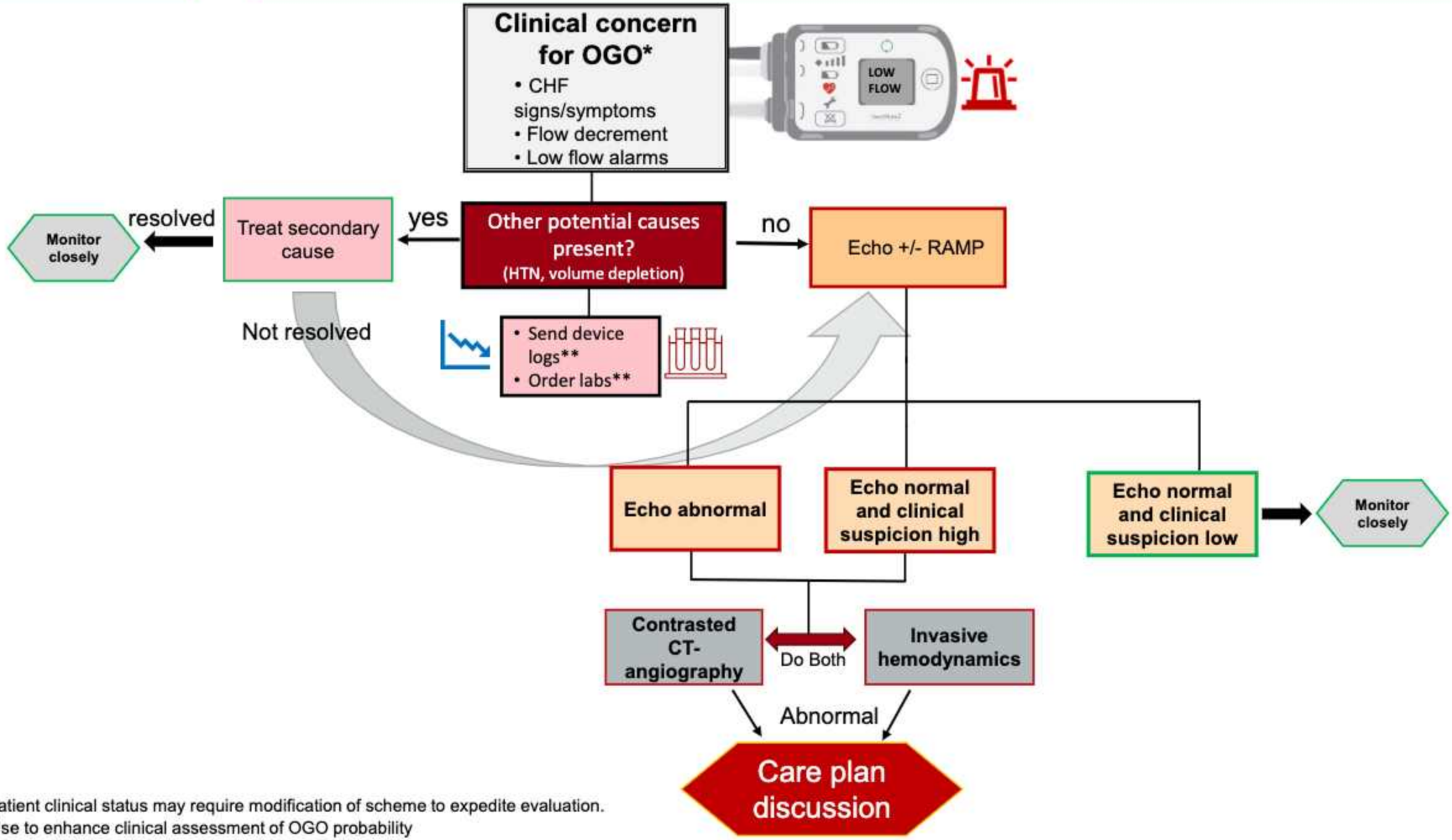




NORMAL







*Patient clinical status may require modification of scheme to expedite evaluation.
**Use to enhance clinical assessment of OGO probability

Management of Outflow Stenosis

- Outflow Graft Stent (case reports)
- Surgical Intervention
- Transplant in those eligible

Recommendations for management of outflow graft obstruction: (New)

Class I

1. Surgical intervention is indicated in patients with documented, hemodynamically significant outflow graft obstruction.

Level of Evidence C. *(New)*

Class IIb:

1. Percutaneous treatment approaches are reasonable to consider in select patients with documented, hemodynamically significant outflow graft obstruction.

Level of Evidence B. *(New)*

Saeed, J Heart Lung Transplant. 2023 Jul;42(7):e1-e222.

Extrinsic Outflow Graft Obstruction of the HeartMate 3 LVAD:

A State-of-the-Art Review

JHLT 2024; in near press

Daniel J. Goldstein MD[1], Manreet Kanwar MD[2], Jennifer Cowger MD[3], Snehal Patel MD[4], Dan M Meyer MD[5], Ezequiel Molina MD[6], Christopher Salerno MD[7], Ashley Elmer BS[8], Sarah Schettle PA-C, MBA[9], Jeffrey Teuteberg MD[10], Francis Pagani MD PhD[11], Josef Stehlik MD[12]

HENRY FORD HEALTH

Infection in MCS Patients

MCS Specific Infection vs. nonMCS

MCS Specific Infection

nonMCS Infection

Driveline Infection

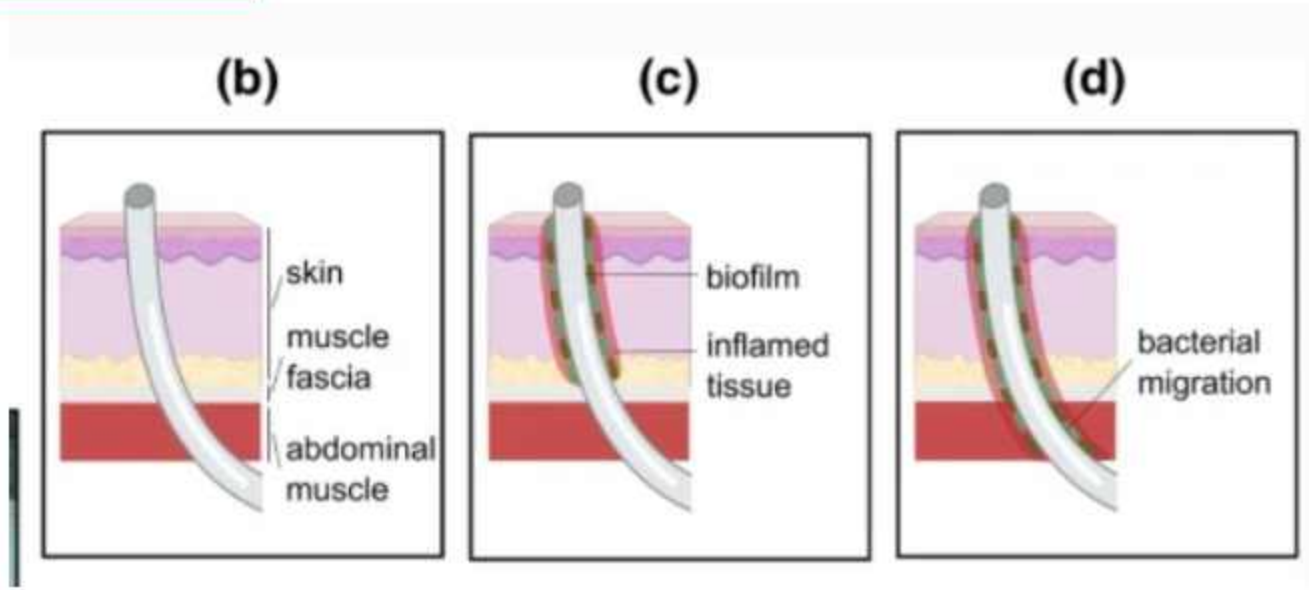
Pump

Superficial

Above muscle/fascia

Deep

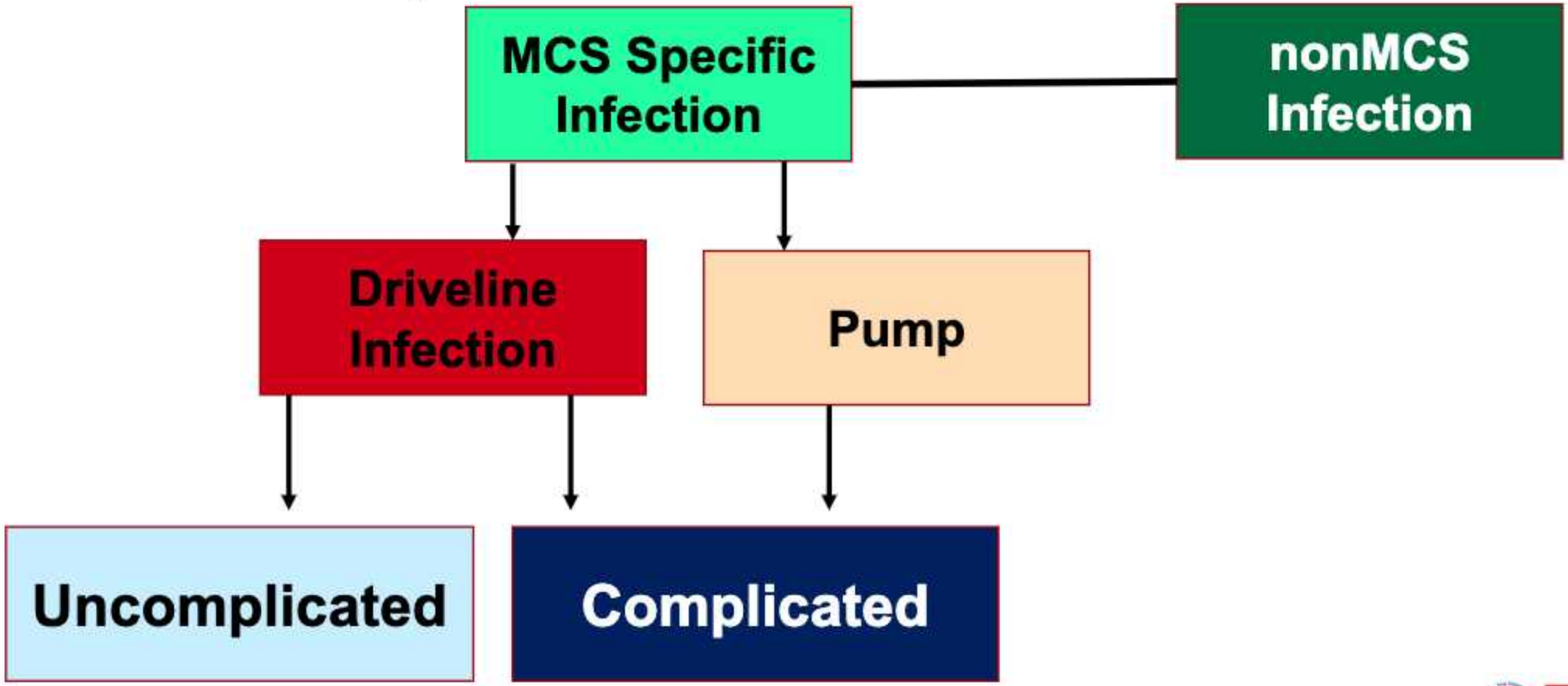
Within muscle/fascia



Kusne S, Mooney M, Danziger-Isakov L, et al.: An ISHLT consensus document for prevention and management strategies for mechanical circulatory support infection. J Heart Lung Transplant 2017;36:1137-53.

European Biophysics Journal volume 51, pages171–184 (2022

MCS Specific Infection



Aslam, Cowger, Molina J Heart Lung Transplant 2024;in press (available on line)

CONSENSUS STATEMENT

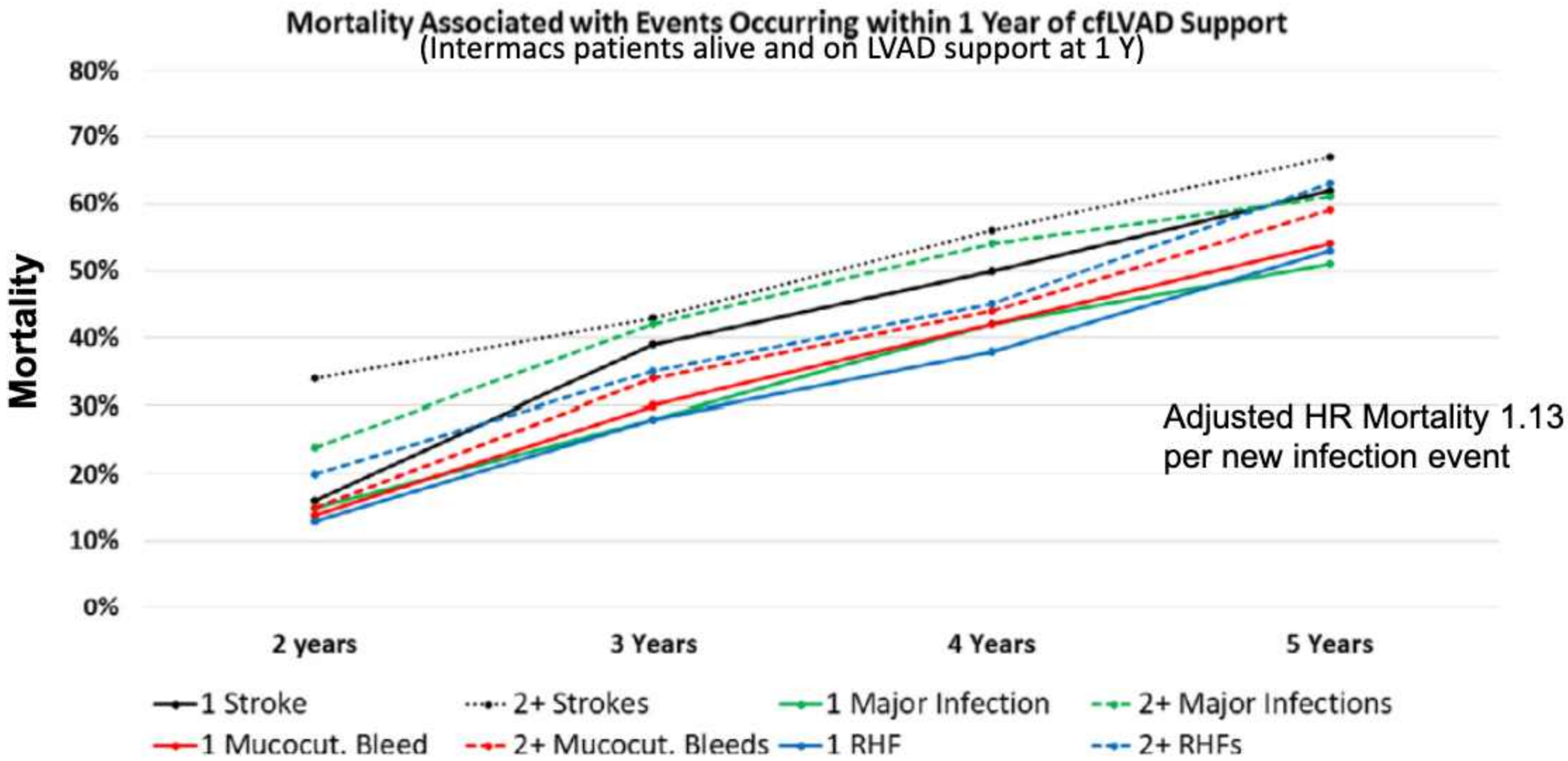
THE INTERNATIONAL SOCIETY FOR HEART AND LUNG TRANSPLANTATION (ISHLT): 2024 INFECTION DEFINITIONS FOR DURABLE AND ACUTE MECHANICAL CIRCULATORY SUPPORT DEVICES[1]

Table 2 Definitions of MCS-Specific Infections Incorporating Both Durable and Acute MCS Devices

Classification	Diagnostic criteria	Investigation
Uncomplicated percutaneous lead infection	• Pain, tenderness, erythema, drainage, and/or induration at the percutaneous lead (driveline) site • Positive drainage culture may be present. • Blood cultures are negative. • Systemic signs of infection are absent, and imaging is negative for fluid collection/abscess. • Clinical improvement or resolution with antibiotics.	• Drainage sample for bacterial and fungal culture. • Bacterial and fungal blood cultures drawn from peripheral sites. • Computed tomographic or ultrasound imaging of the affected area to assess for deeper infection/fluid collection. • Direct surgical visualization is not needed.
Complicated percutaneous lead infection	• Pain, tenderness, erythema, drainage, induration, and/or fistulous tract at the percutaneous lead (driveline) site; and/or • Fluid collection/abscess at exit site noted on imaging with positive culture; and/or • Radiographic evidence of findings consistent with infection along the path of the lead; and/or • Presence of systemic signs/symptoms including fever, chills, leukocytosis, systemic inflammatory response syndrome, and sepsis; and/or • Positive drainage or blood cultures (bloodstream infection); and/or • Cultures demonstrating multidrug-resistant organisms or fungi; and/or • Presence of infection of the external surfaces of an implantable component	• Drainage sample for bacterial and fungal culture. • Bacterial and fungal blood cultures drawn from peripheral sites. • Computed tomographic or ultrasound imaging of the affected area to assess for deeper infection/fluid collection. FDG/PET or PET/CT can be used as well, if available, in the setting of VAD infections. • Direct surgical visualization • Tissue, fluid, and/or lead material sample for bacterial and fungal culture (surgical specimen)

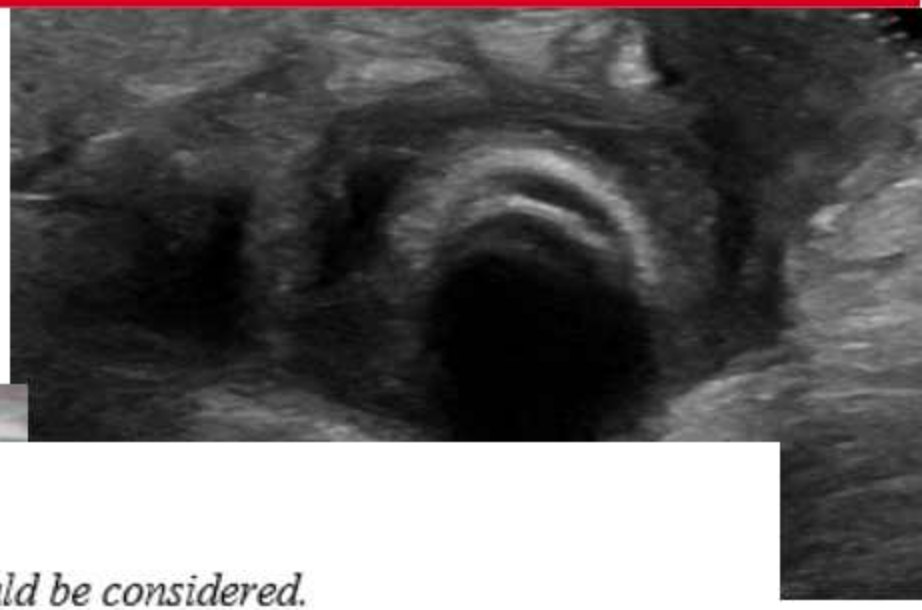
Aslam, Cowger, Molina J Heart Lung Transplant 2024;in press (available on line)

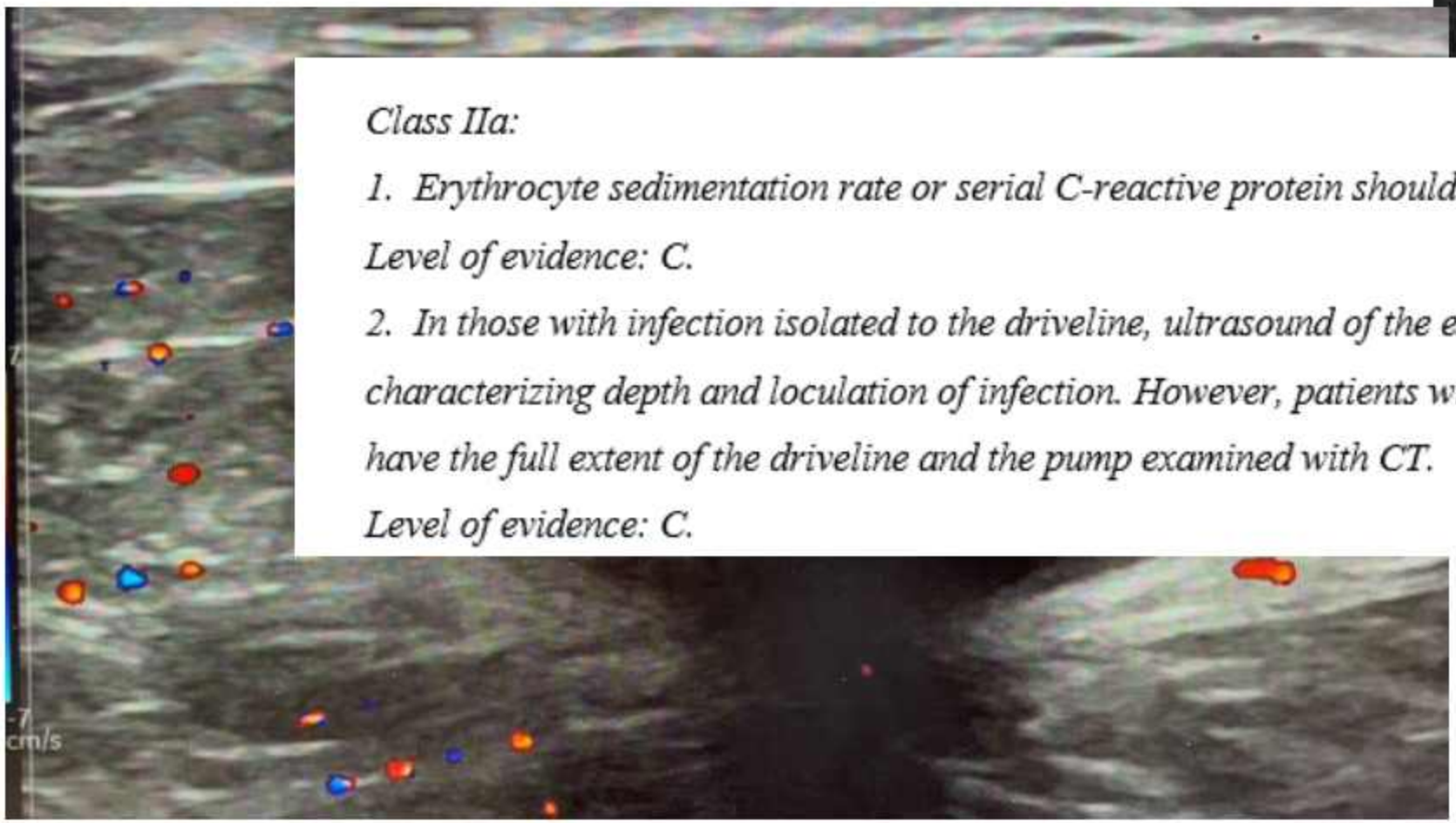
Impact of Infection on Long-term Survival



Hariri Cowger JHLT 2022;41(2):161-170.

Ultrasound





Class IIa:

1. Erythrocyte sedimentation rate or serial C-reactive protein should be considered.

Level of evidence: C.

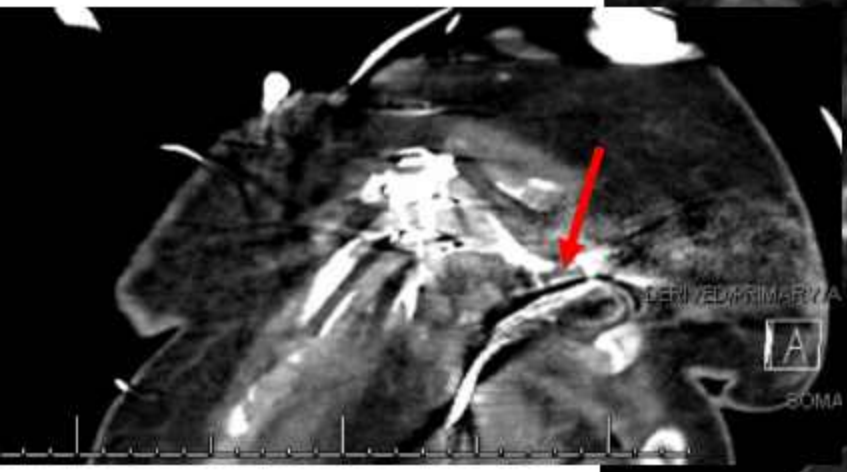
2. In those with infection isolated to the driveline, ultrasound of the exit site may be useful for characterizing depth and loculation of infection. However, patients with concern for deep infections should have the full extent of the driveline and the pump examined with CT.

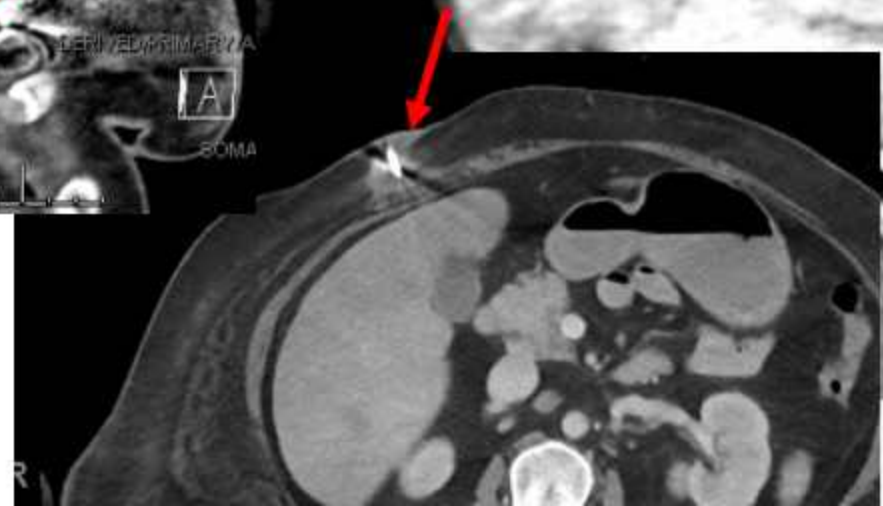
Level of evidence: C.

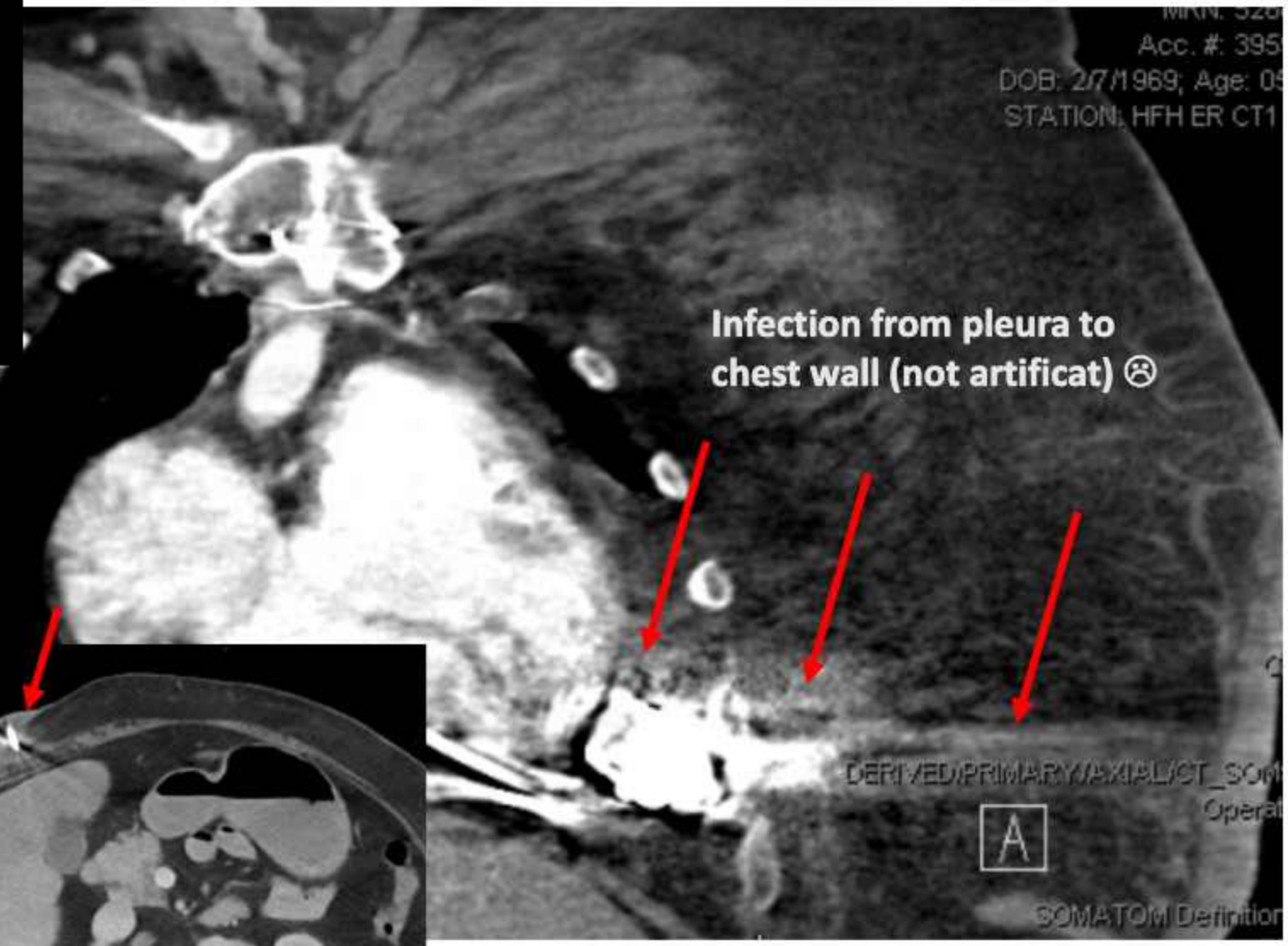
Saeed, Feldman, et al 2023 MCS Guidelines. JHLT 2024

CT Scanning


37.4 mm






Acc. #: 395
DOB: 2/7/1969; Age: 0
STATION: HFH ER CT1
Infection from pleura to chest wall (not artificat) ☹
A
SOMATOM Definition

Management of Driveline Infection

Class I Guidelines

Superficial DL Infection

Antibiotics: Begin empiric coverage against *Staph* and *Pseudomonas* then narrow down based on culture(s)

Uncomplicated

Duration: 2 weeks

Deep DL infection

Begin empiric coverage then tailor to organism

Complicated

Duration: 6-8 weeks **IV** and then **chronic oral suppression**

Consider surgical drainage, uplisting, full device exchange*

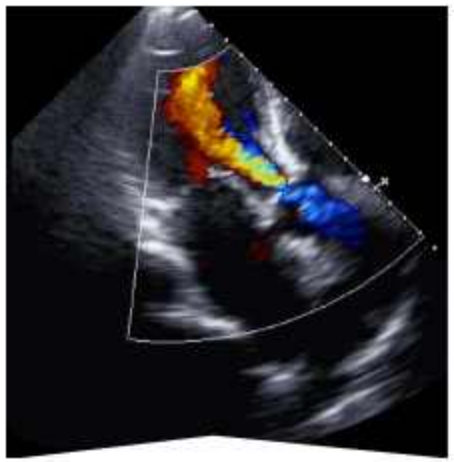
*LVAD exchange for infection: use distinct operative field/planes to avoid contamination of the new pump (Class IIb, Level of evidence C).

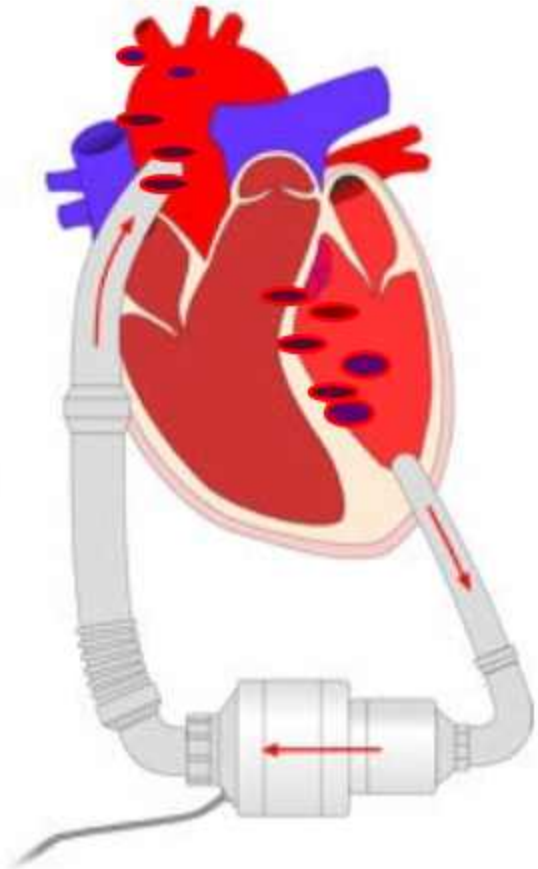
Saeed, Feldman, et al 2023 MCS Guidelines. JHLT 2024

Aortic Insufficiency During LVAD Support

- Aortic insufficiency (AI) can lead to ineffective LVAD output via recirculation

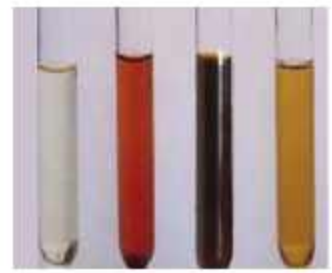
- Patients can become “under supported” and develop CHF despite high or normal LVAD flows





Clues that AI is Problem

- **Clinical:**
  - Recurrent/progressive HF signs/symptoms despite good LVAD flows
  - Hemolysis (↑ LDH)
  - New/recurrent VT
  - Low PI, increased flows >> CO



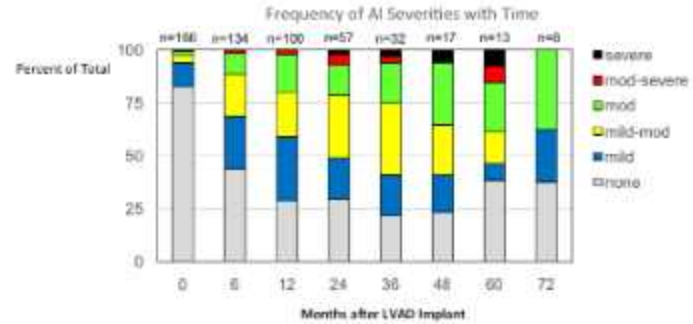
- **Echo: (besides AI)**
  - New/worsening right heart failure
  - New/worsening mitral regurgitation or ↑↑LViDd
- **Catheterization:**
  - Persistently high pulmonary capillary wedge pressure
  - Cardiac output << measured LVAD flow

Cumulative Incidence of AI on HMII and HVAD

~20% mod AI at 12 months

		Days of		Incidence of AI	
	AI grade	Follow-up	Devices	6 mo	12 mo
Cowger[1]	≥ moderate	239 [112, 455]*	Pulsatile n=25	0%	20%
			CF n=53	14%	28%
Hatano[2]	≥ mild to moderate	571±374	Pulsatile n=28	0%	2%
			CF n=9	9%	20%
Pak[3]	≥ mild to moderate	176±143	Pulsatile n=67	5%	11%
			CF n=63	16%	25%
Soleimani[4]	≥ mild to moderate	314±289	HMII n=58 Heartware n=8	0%	32%
Cowger[5]	≥ moderate	461 [236,886]	HMII n=166	8%	20%
Jorde[6]	≥ moderate	344±352	HMII n=223 Heartware n=9	5%	20%

*median [25th, 75th] otherwise mean±std dev



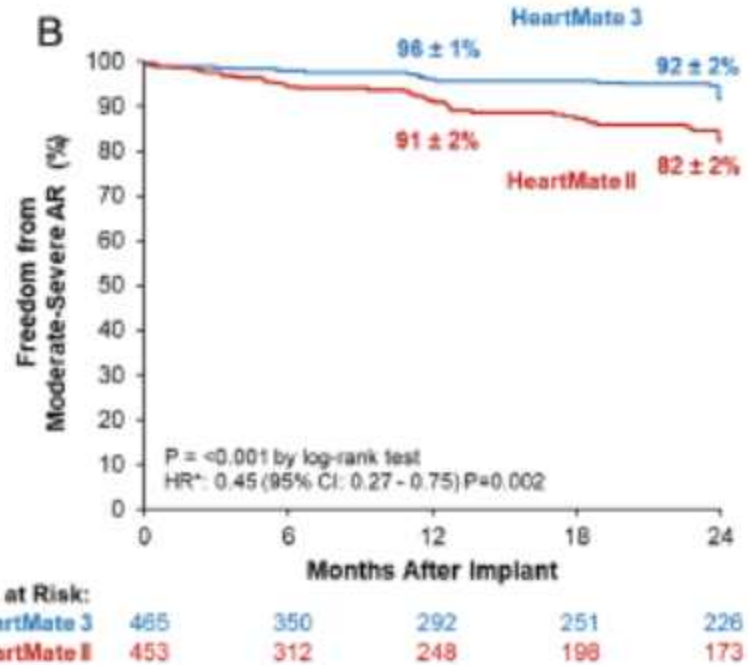
Cowger, JHLT 014;33:1233–1240

AI Development on HM3

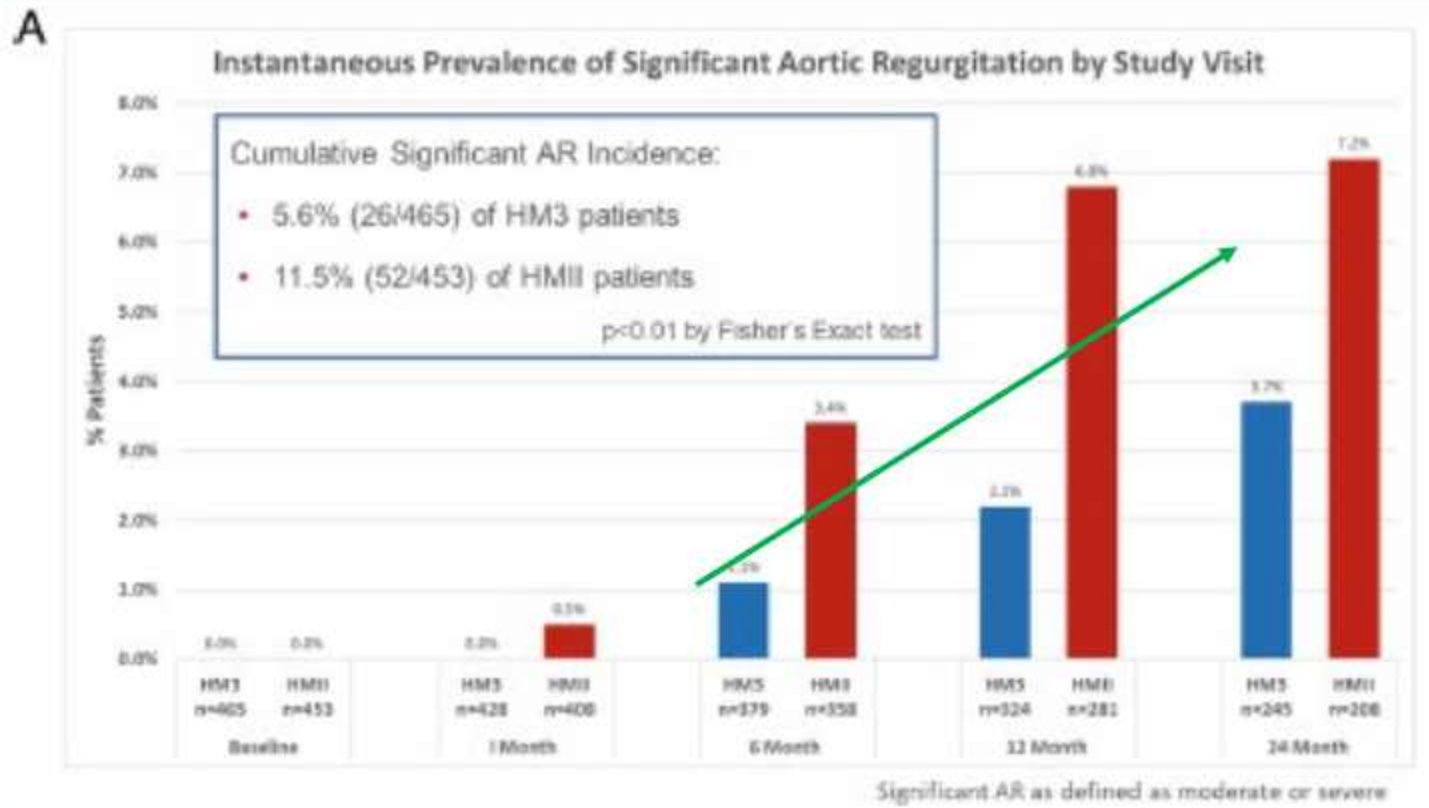
	Devices (n)	AI 1 Year ≥Moderate AI	AI 2 Years ≥Moderate AI	Other
Imamura, 2020	HM3 (n=41)	19.5% (n=8)	N/A	Increased AI noted in higher BSA, **higher device speed, DT**
Contreras, 2022	HMII (n=536) HM3 (n=300)	6% 3%	16%* 8%*	Increased AI **noted in females, smaller BSA**, preop AI, HMII
Malick, 2022	HMII (n=270) HM3 (n=121)	6% 0-3%*	-- --	Increased AI noted in **females** and prior stroke, **trends for older age**
Uriel, 2023	HMII (n=453) HM3 (n=465)	5% 4%	18% 8%	Increased AI noted in **older patients and females**, trends for AI preop

*no HM3 patient had moderate or worse AI at 1 year but ~3% had moderate AI at 6 months

MOMENTUM 3 Data

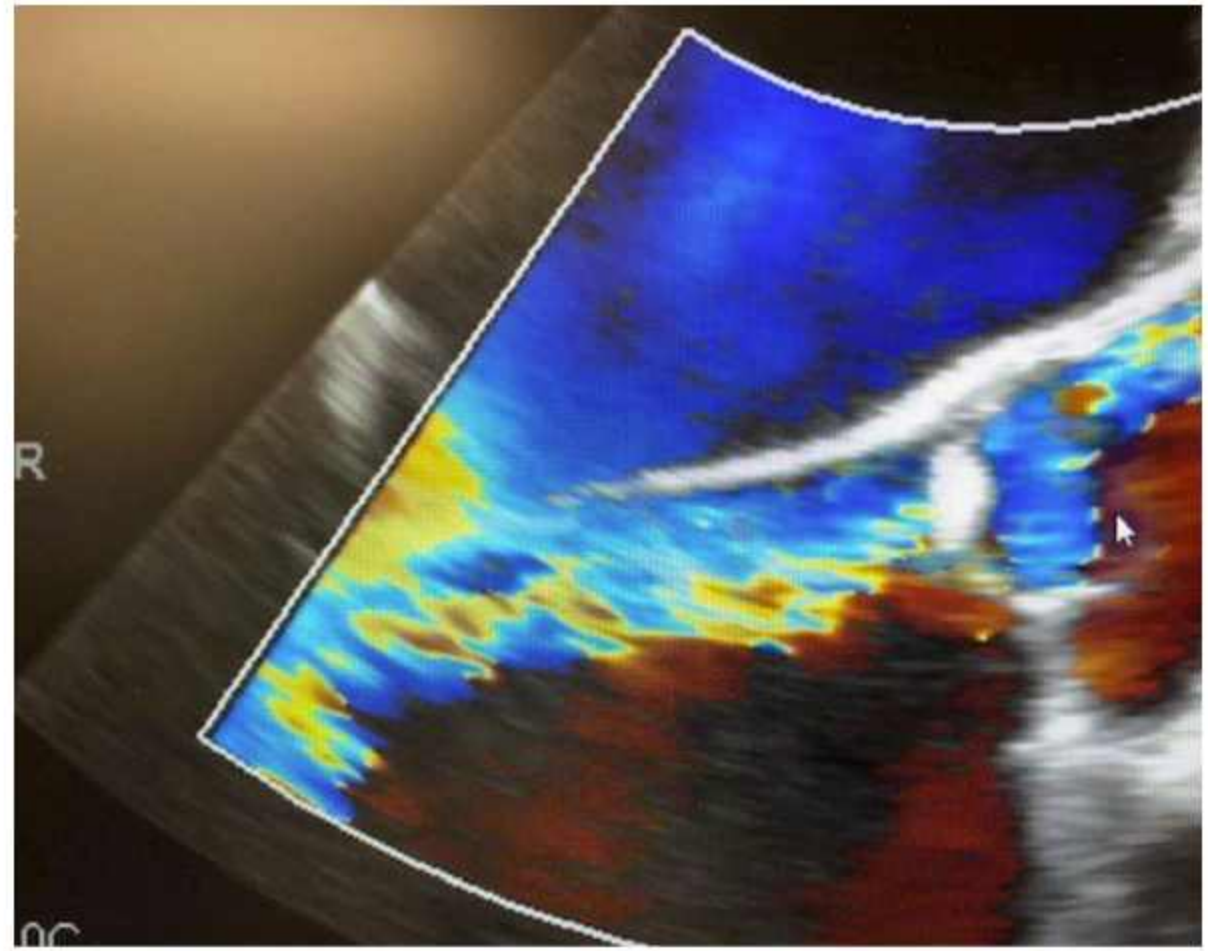


* Hazard Ratio controlled for Age, Gender, Etiology of HF, LVEDD, History of AF and History of AR



ESC European Society of Cardiology
European Journal of Heart Failure (2023) 25, 286–294
doi:10.1002/ejhf.2746

Echo Diagnosis of AI



ASE Recommendations for AI Assessment

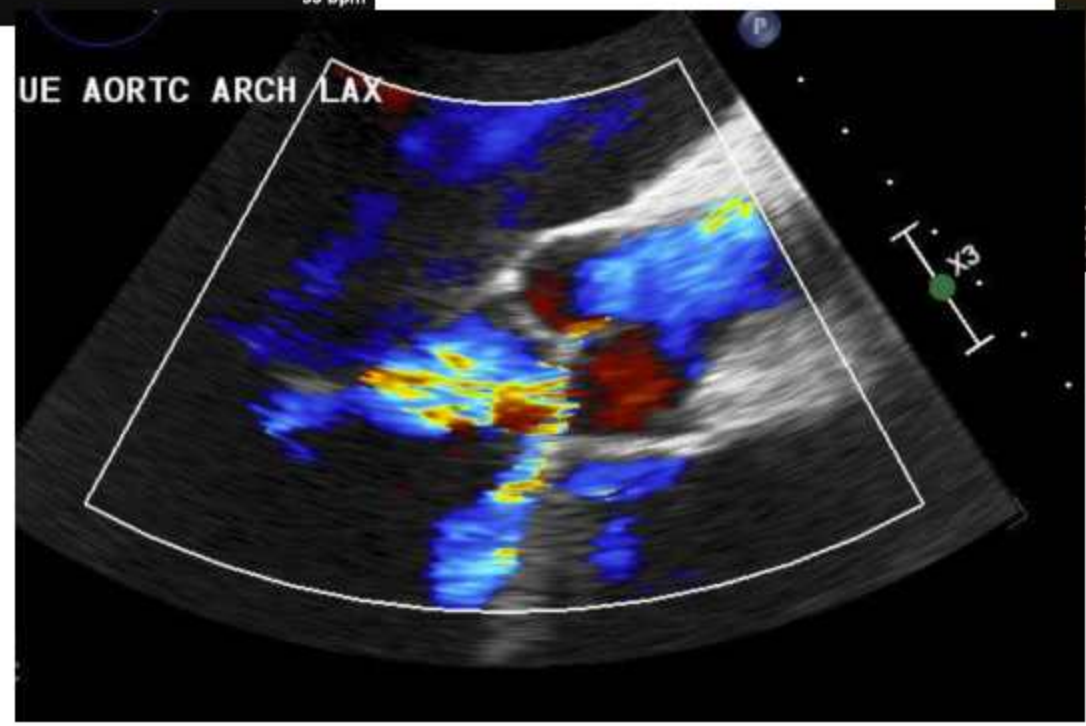
Table 1 Qualitative and Quantitative Parameters Useful for Grading AI

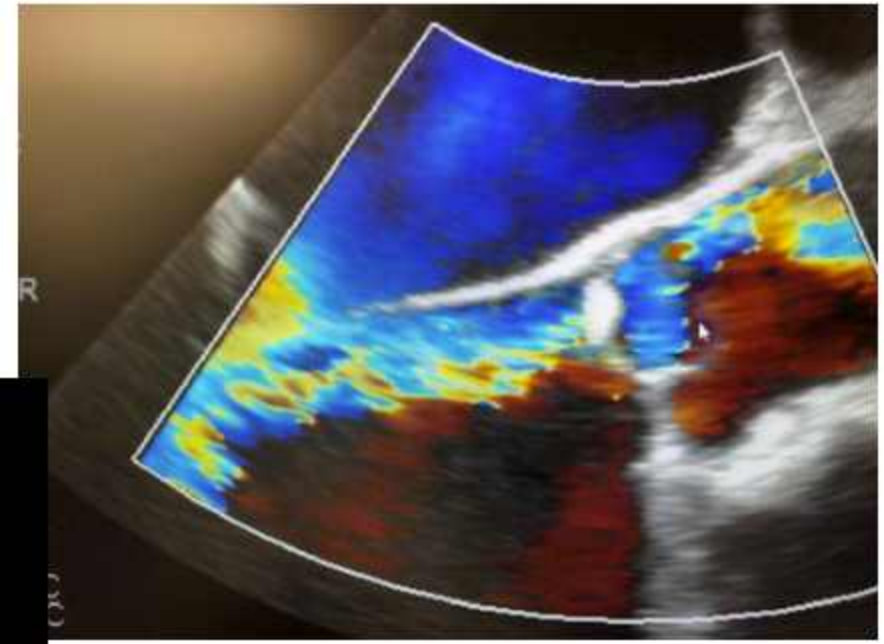
	Mild	Moderate	Severe
Structural parameters			
LA size	Normal[a]	Normal or dilated	Usually dilated[b]
Aortic leaflets	Normal or abnormal	Normal or abnormal	Abnormal/flail or wide coaptation defect
Doppler parameters			
Jet width in LVOT (color flow)[c]	Small in central jets	Intermediate	Large in central jets; variable in eccentric jets
Jet density (CW)	Incomplete or faint	Dense	Dense
Jet deceleration rate (CW; PHT, ms)[d]	Slow >500	Medium 500–200	Steep <200
Diastolic flow reversal in descending aorta (PW)	Brief early diastolic reversal	Intermediate	Prominent holo-diastolic reversal
Quantitative parameters[e]			
VC width (cm)[c]	<0.3	0.3–0.6	>0.6
Jet width/LVOT width (%)[c]	<25	25–45 mild–moderate, 46–64 moderate–severe	≥65
Jet CSA/LVOT CSA (%)[c]	<5	5–20 mild–moderate, 21–59 moderate–severe	≥60
R Vol (ml/beat)	<30	30–44 mild–moderate, 45–59 moderate–severe	≥60
RF (%)	<30	30–39 mild–moderate, 40–49 moderate–severe	≥50
EROA (cm^2)	<0.1	0.1–0.19 mild–moderate, 0.2–0.29 mod–severe	≥0.30

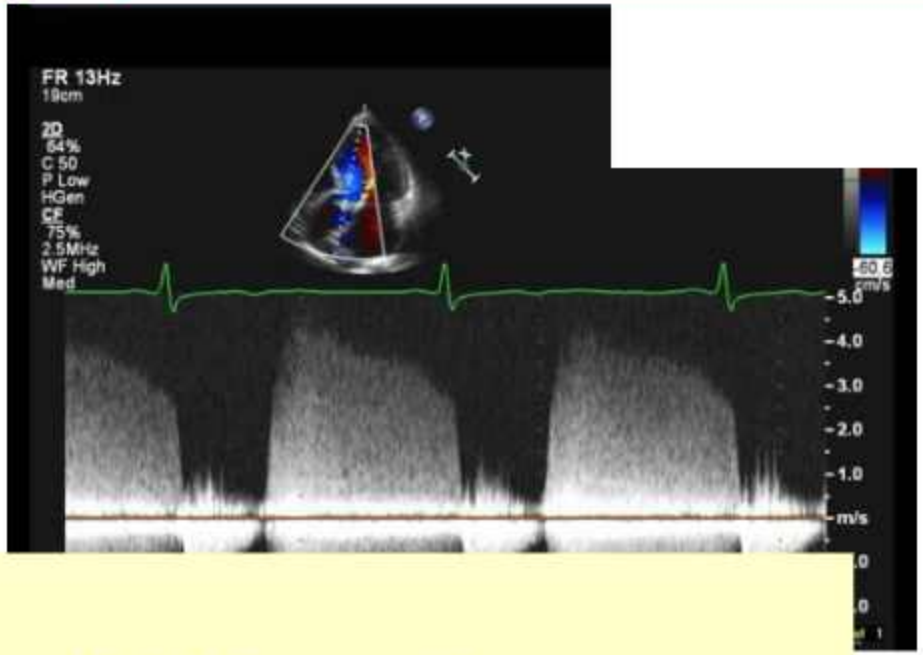
Zoghbi et al. J Am Soc Echocardiography 2003;16:777-802 Cowger/Estep et al. J Heart Lung Transplant 2015;34:149-57

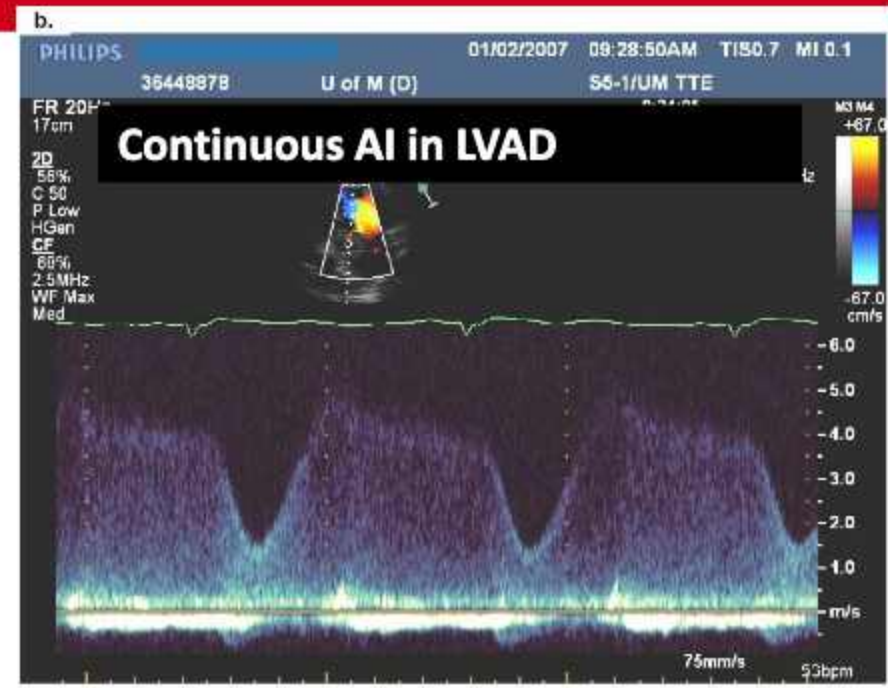
AI Post LVAD


PHILIPS
01/02/2007 09:21:00AM TIS2.2 MI 1.2
S5-1/UM TTE
FR 16Hz
15cm
2D
46%
C 50
P Low
HGen
CF
68%
2.5MHz
WF Max
Med
M3 M4
+67.0
-67.0
cm/s
JPEG
55 bpm


UE AORTC ARCH LAX
X3



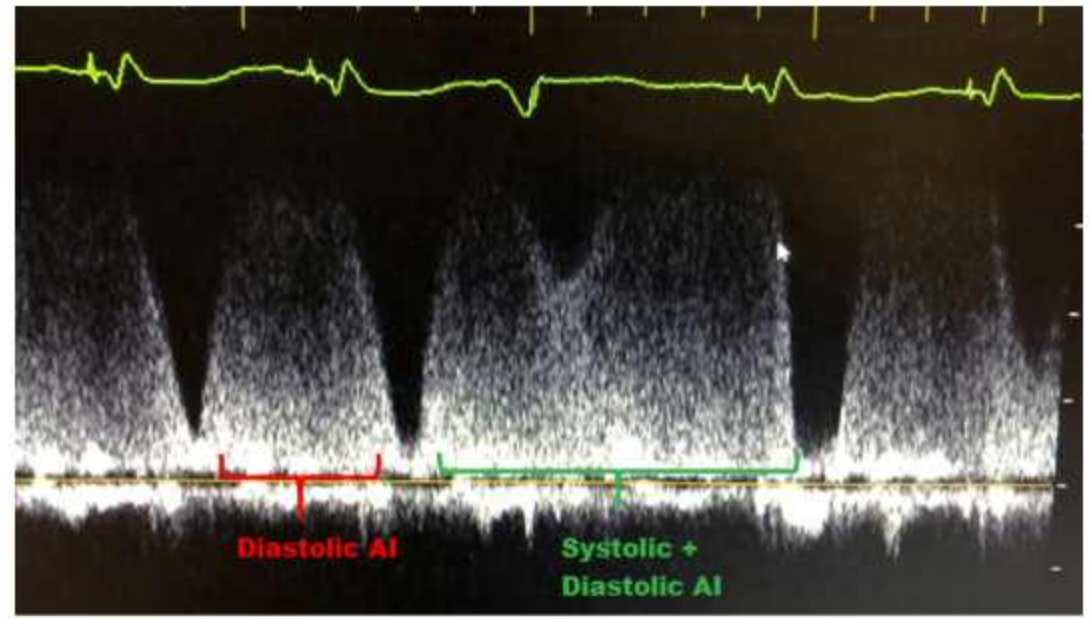




If AI is <u>continuous</u> during diastole and systole:

= higher regurgitant fraction

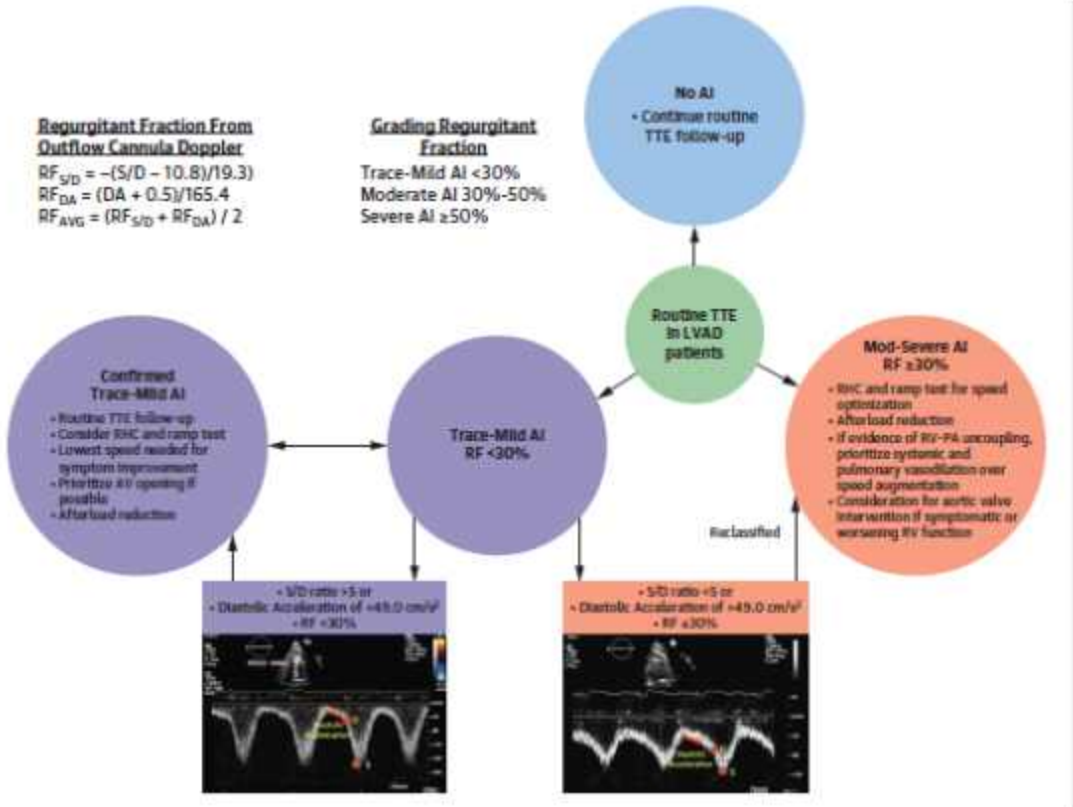
"Mild AI" ≠ **Mild AI**

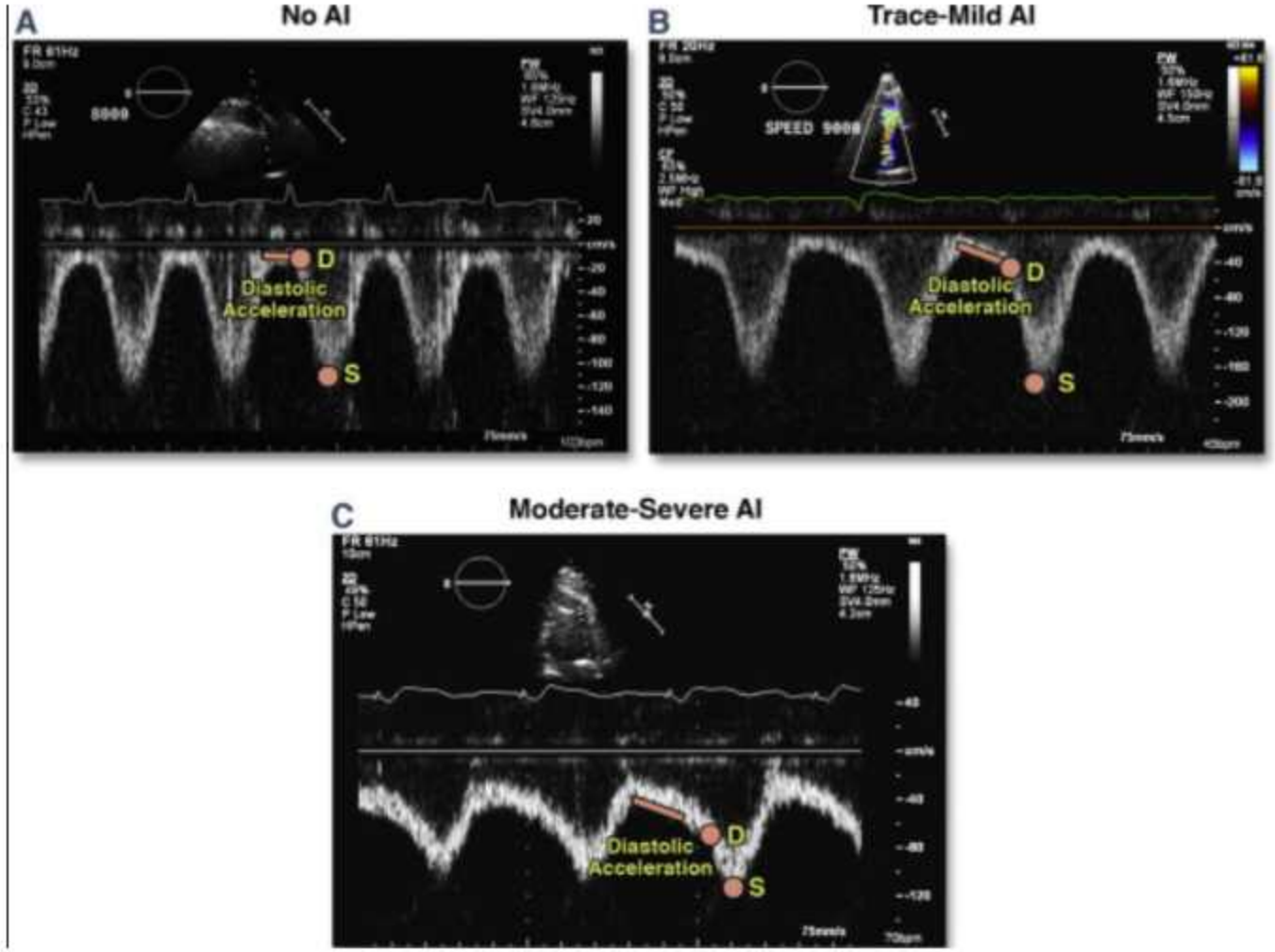


$\Delta P_{AI} = P_{Ao} - P_{LV}$

Cowger in Transplantation and Mechanical Support for End Stage Heart and Lung Disease, Wiley.

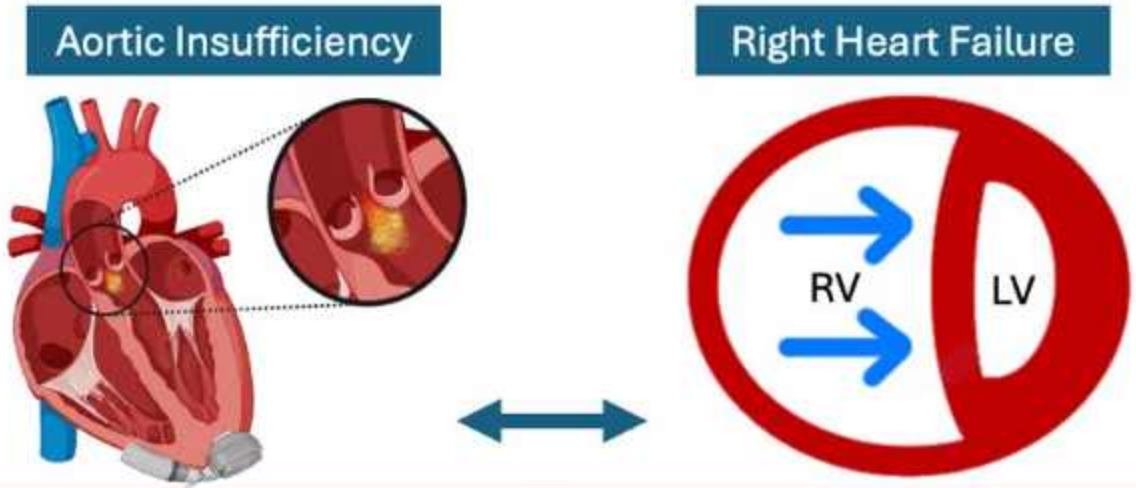
Pulsed Doppler of Outflow at Aorta





(J Am Coll Cardiol 2023;82:70-81)

Hemodynamic Related Events



- Interplay between hemodynamic impact of both AI and RHF
- Uncoupled right heart (RVF) poorly tolerates AI
  - AI is less responsive to speed increase

Grinstein J Am Coll Cardiol. 2023 Jul, 82 (1) 70–81

Saeed, Grinstein, Kremer, Cowger. J Heart Lung Transplant 2024 (in review)

Management of AI

- Prevention: AVR (Replace or Park stitch)
- Maintain afterload reduction (MAP 70-90 mmHg)
- Speed increase; less benefit in RHF (uncoupled RV)
- TAVR or S-AVR
- Transplant

Recommendations	Class	Level	References
Treatment of moderate aortic insufficiency			
Variation in pump speed settings to reduce aortic insufficiency should be considered.	IIa	B	[68]
A heart transplant is recommended.	I	C	
Open valve replacement or closure of an insufficient aortic valve is not recommended.	III	C	
Interventional closure of the aortic valve may be considered.	IIb	C	[458, 461, 464]
Transcatheter aortic valve replacement should be considered.	IIa	C	[461, 465, 466]
Treatment of severe aortic insufficiency			
Reduction in pump speed settings to reduce aortic insufficiency may be considered.	IIb	C	[68]
High-urgent listing for a heart transplant is recommended if the patient is a transplant candidate.	I	C	
Open valve replacement or closure of the insufficient aortic valve may be considered.	IIb	C	[457, 467]
Interventional closure of the aortic valve may be considered.	IIb	C	[458, 461, 464]
Transcatheter aortic valve replacement should be considered.	IIa	C	[461, 465, 466]

Potapov, Euro J of Cardio-Thoracic Surgery 2019;56:230–270

Summary

- Infection, right heart failure, and aortic insufficiency are likely the greatest sources of morbidity in patients on contemporary LVAD support
  - All are insufficiently studied or captured in trials/databases
- Afterload control is needed for optimal device function and AE mitigation, notably Aortic Insufficiency
  - Goal MAP 70-90 mmHg
- Medical management of heart failure in the LVAD patient should mimic present societal GDMT guidelines for the nonLVAD HFrEF patient:
  - 4 Pillars of Therapy
- EOGO
  - Not common
  - Diagnosed with persistent low flows and reduce powers and PI
  - Treat with stent, transplant, surgery

HENRY FORD HEALTH

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DEBATE: It's Time for Universal DT in Canada

Michael McDonald
MD, FRCPC

Jonathan Howlett
MD

Disclosures

	Dr. Michael McDonald	Dr. Jonathan Howlett
Any direct financial payments including receipt of honoraria	Novartis	Novo Nordisk, Novartis
Membership on advisory boards or speakers' bureaus	Novo Nordisk, Boehringer Ingelheim-Lilly	Novo Nordisk, Novartis
Funded grants or clinical trials	No disclosures	Novo Nordisk, Novartis, Pfizer
All other investments or relationships that could be seen by a reasonable, well-informed participant as having the potential to influence the content of the educational activity	No disclosures	Provincial HF Working group Alberta Health Services. Associate Editor, Merck Manual Several Journal Editorial Boards

Learning Objectives

1. Compare the patient's outcomes and satisfaction with and without DT MCS
2. Contrast the difference between provinces in access to DT MCS
3. Critique the impact of DT MCS on global health care in Canada

Pro: It's (Now) Time for Universal Destination Therapy LVADs in Canada

Michael McDonald
MD, FRCPC

Classic David and Goliath Matchup

Goliath Biography

- Many accomplishments in battle
- Feared and respected
- Imposing character
- *Notable blind spots*
- *Died while underestimating his opponent*

DT VAD in Canada
Closing Arguments First

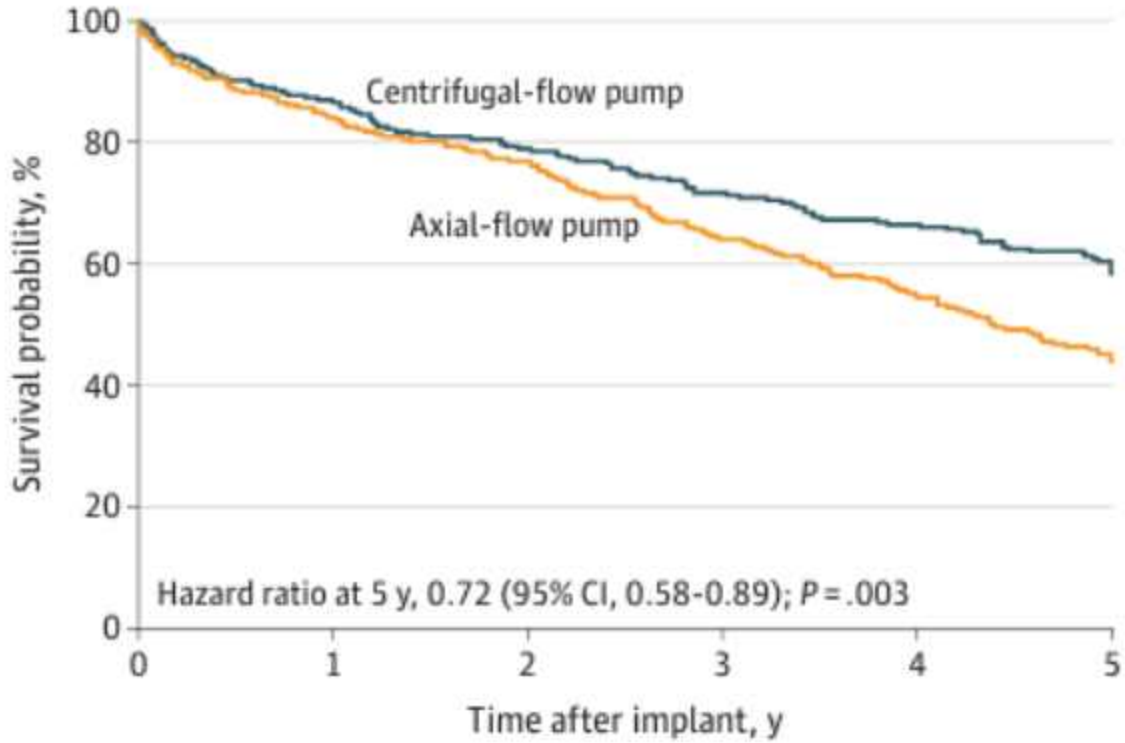
1. Clinical effectiveness of current LVADs for destination therapy is well-established

2. Access to DT VAD in Canada is variable and not equitable

3. Universal DT VAD will not have an impact on global health care costs in Canada

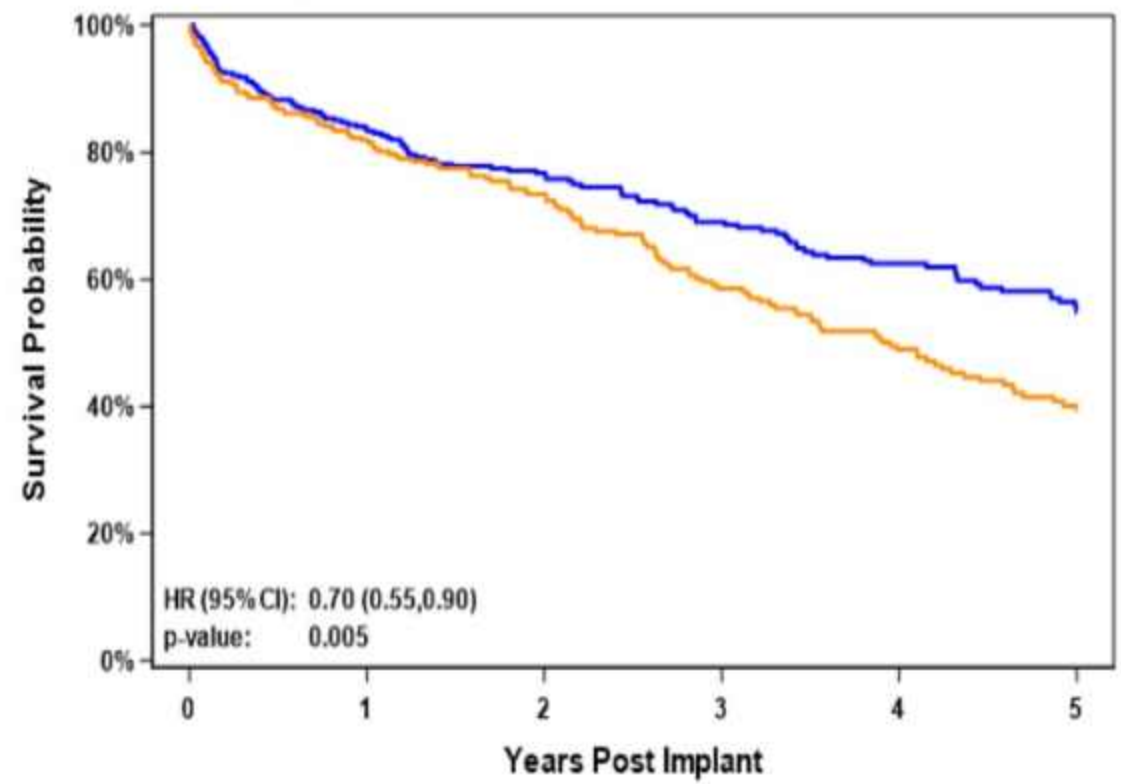
Contemporary Outcomes with LVAD Therapy: HeartMate 3™

Overall survival:
5-year follow-up MOMENTUM 3 Trial



Centrifugal flow	515	383	289	213	184	141
Axial flow	505	339	247	165	124	85

Destination Therapy Subgroup
(>60% of trial population)



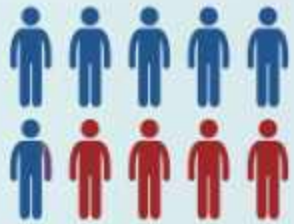
	317	249	203	150	127	96
	307	224	174	114	83	58

Mehra et al, JAMA 2022

Contemporary Outcomes with LVAD Therapy: HeartMate 3™

Clinical trial experience
MOMENTUM 3-Randomized Controlled Trial (USA)

Five-year survival



58.4%

Quality of life

EQ-5D VAS*

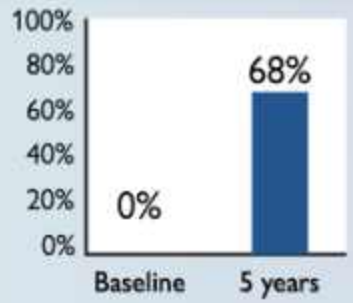
Increase of 52%

Functional capacity at five years

6MWD

Gain of 134 meters
(2x from baseline)

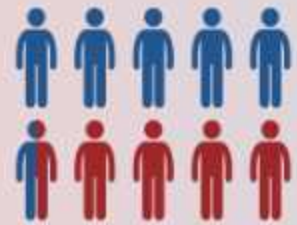
NYHA class I-II



$^{2}/_{3}$ with none to mild symptoms

Real world experience
ELEVATE Registry (Non-USA, Global)

Five-year survival



56.3%

Quality of life

EQ-5D VAS*

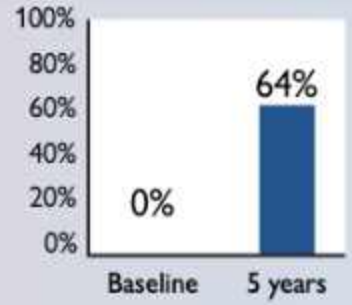
Increase of 91%

Functional capacity at five years

6MWD

Gain of 197 meters
(3x from baseline)

NYHA class I-II



$^{2}/_{3}$ with none to mild symptoms

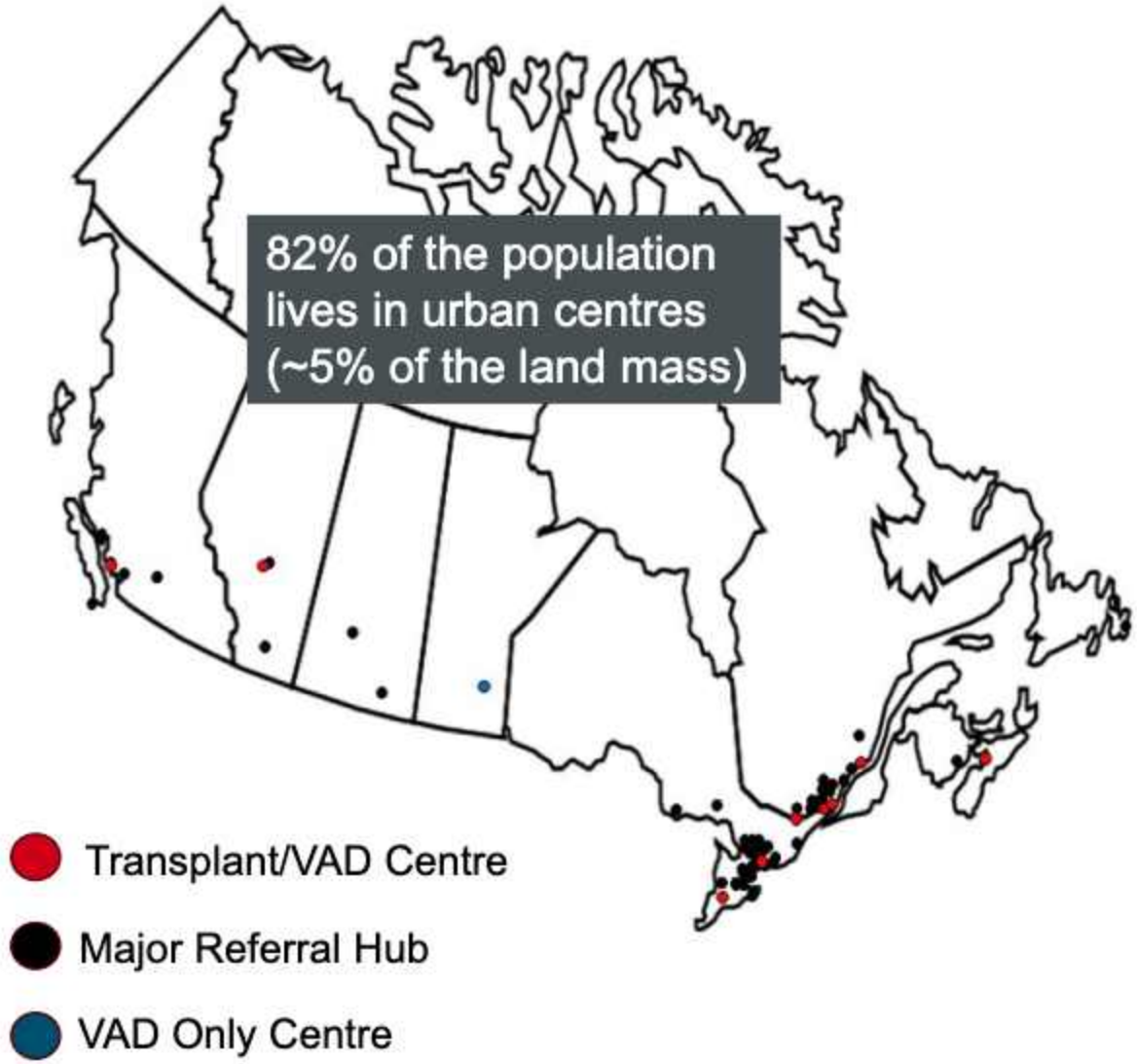
Median Survival Medical Therapy: 1-2 years
Median Survival LVAD: 5 years

Mehra et al, JAMA 2022

Schmitto et al, Eur Heart J 2024

Mehra et al, Eur Heart J 2024

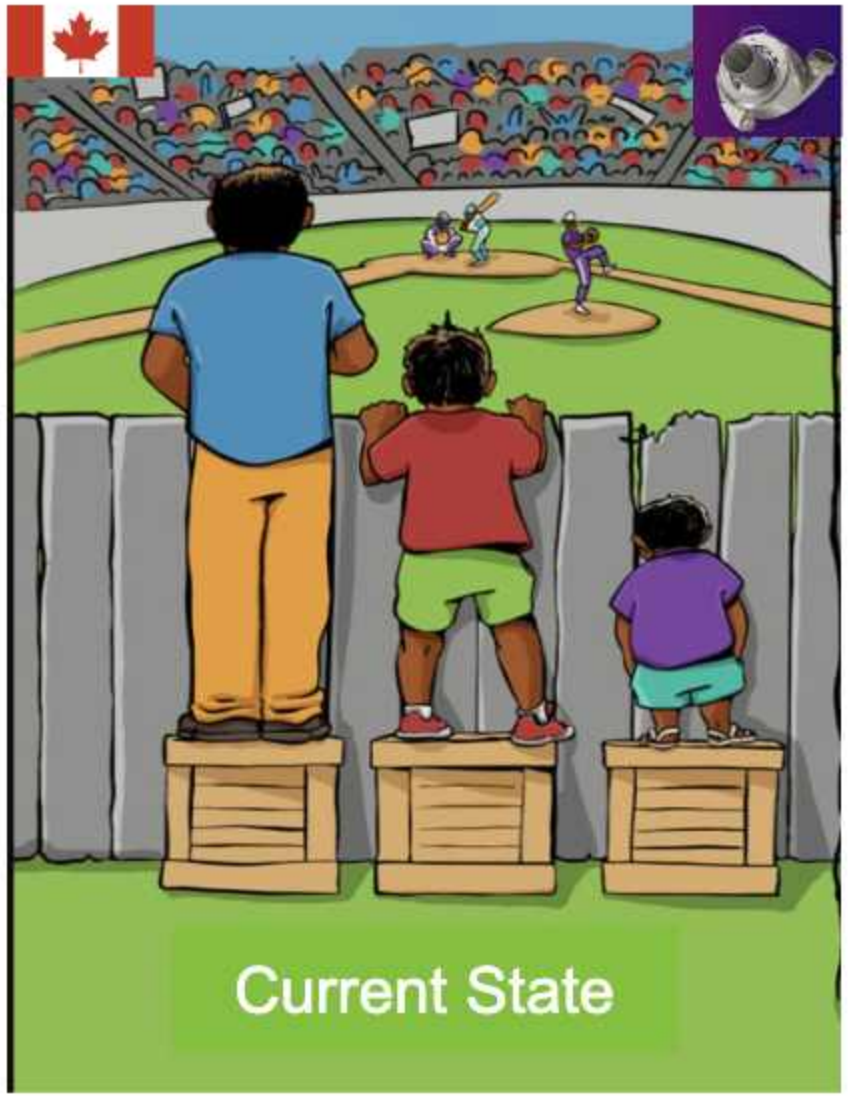
Access to DT VAD is Uneven and Unequitable



	DT Offered	Funding
BC	No	BTT only
Alberta	Edmonton	VAD Operating $
Sask	Edmonton	Reimbursed
Manitoba	No	BTT only
ON	Yes	DT funded
Quebec	Yes	DT funded
Atlantic Canada	Halifax	VAD Operating $

Adapted from So et al, Can J Cardiol 2022

Time for Universal Access…
For Provinces, Patients, Providers



It's possible to get into the game….

If you know <u>how</u> and <u>where</u> to go

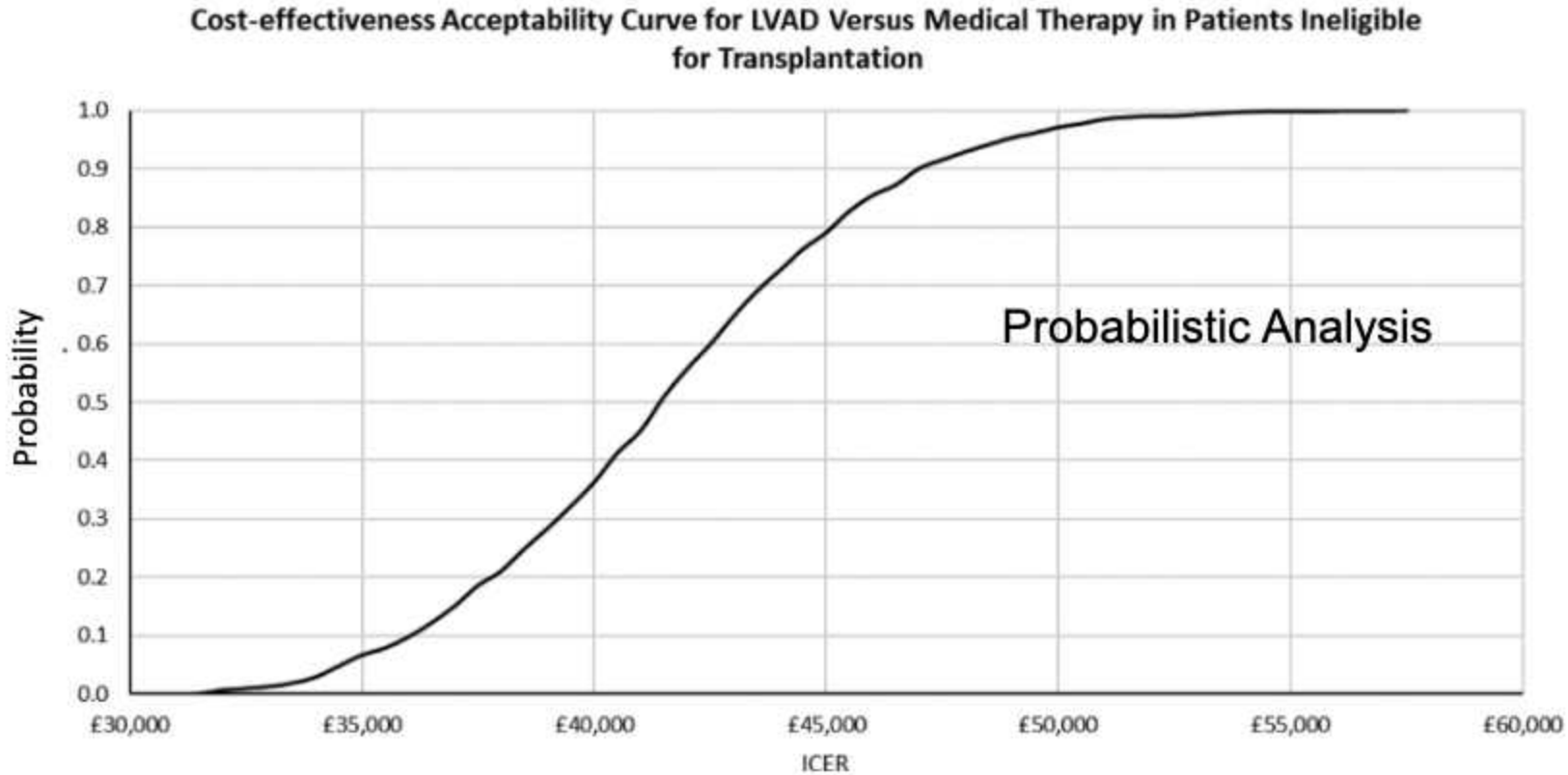
Access for everyone who needs in…

Is DT Cost Prohibitive in the Current Era?

Table 4 Cost-Effectiveness Results

Treatment	Cost	QALYs
LVAD	£141,598	2.8307
Medical therapy	£28,047	0.4331
Incremental cost LVAD	£113,551	
Incremental QALYs LVAD	2.3976	
ICER	£47,361	

ICER $80,513 CAD , HeartMate 3™



- Cost effectiveness analysis: HeartMate 3™ versus medical therapy
- Network meta-analysis using medical therapy groups from ROADMAP and REMATCH study populations
- More likely to be cost-effective in inotrope dependent subgroups

Lim et al, J Heart Lung Transplant 2022

Cost Effectiveness of HF Devices

Device	Setting	Era	ICER* (Canadian $)	Ref.
HeartMate XVE™	Destination Therapy	~2002	1 100,000	Miller, Circulation 2013
HeartMate 2™	Destination Therapy	~2012 ~2017	270,000 126,000**	Rogers, Circ HF 2012 Chew, CJC 2017
HeartMate 3™	Destination Therapy	~2022	81,000	Lim, JHLT 2022

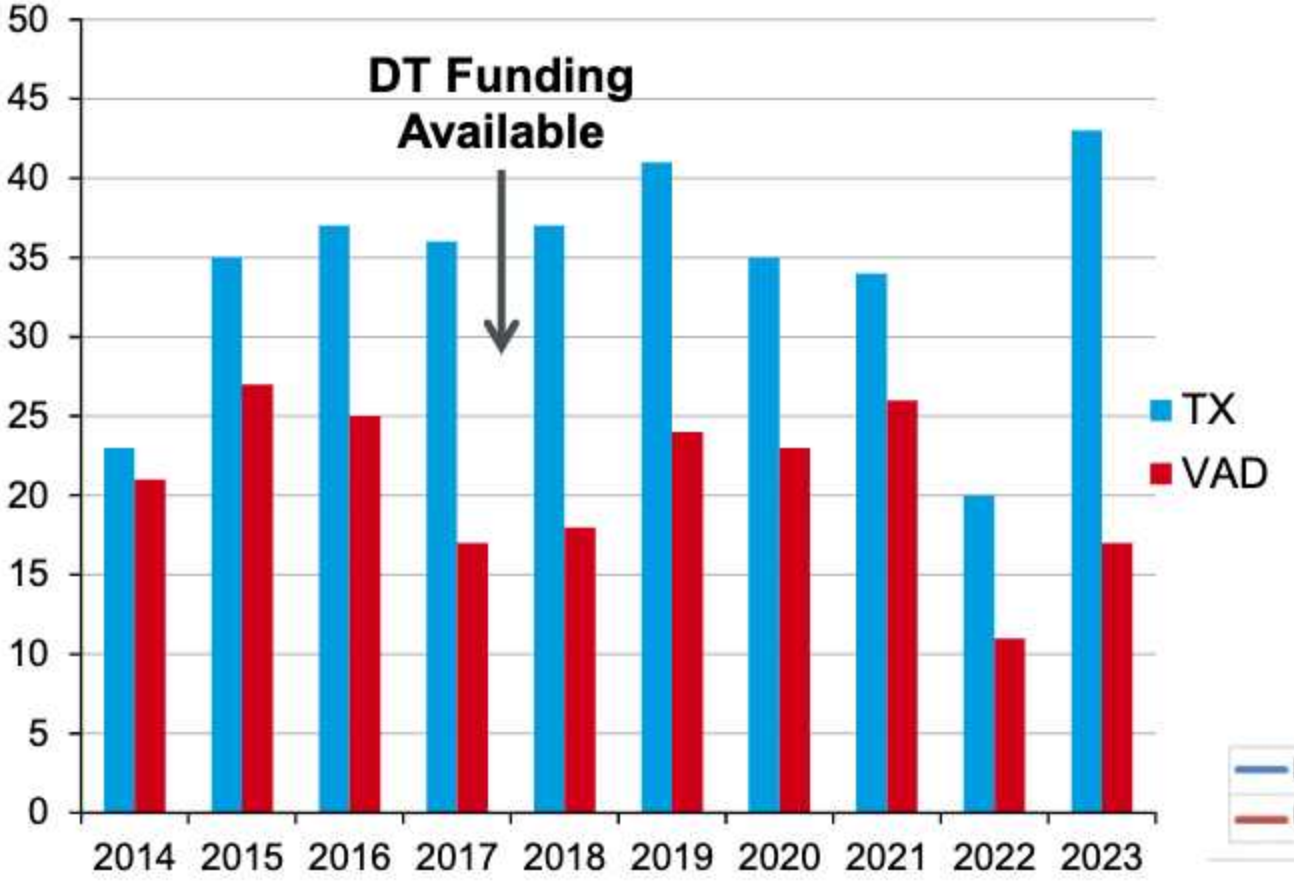
*Compared to medical therapy alone
** Contemporary Canadian analysis

Cost Effectiveness of HF Devices

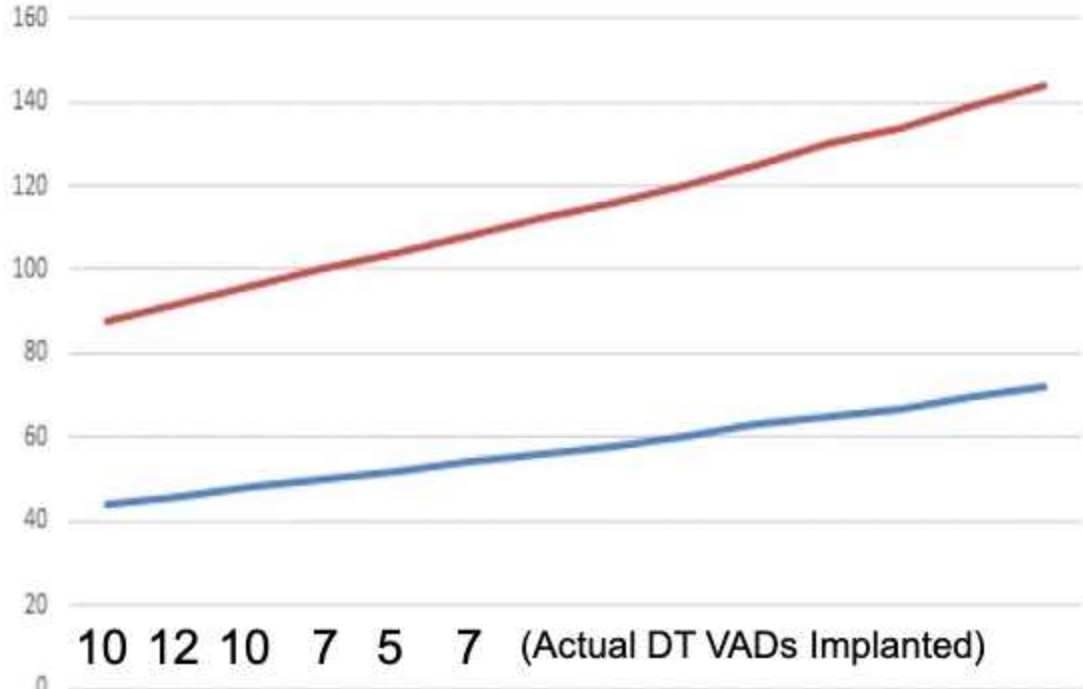
Device	Setting	Era	ICER* (Canadian $)	Ref.
HeartMate XVE™	Destination Therapy	~2002	1 100,000	Miller, Circulation 2013
HeartMate 2™	Destination Therapy	~2012 ~2017	270,000 126,000**	Rogers, Circ HF 2012 Chew, CJC 2017
HeartMate 3™	Destination Therapy	~2022	81,000	Lim, JHLT 2022
ICD	Primary Prevention	~2005	47,000 - 92,000	Sanders, NEJM 2005
MitraClip™	Functional mitral regurgitation	~2019	76,000	Baron, Circulation 2019

*Compared to medical therapy alone
** Contemporary Canadian analysis

DT VAD Experience in Toronto



Projected DT VAD Cases in Ontario, 2017-2030 (CorHealth)



10 12 10 7 5 7 (Actual DT VADs Implanted)

	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31
Lower Range	44	46	48	50	52	54	56	58	60	63	65	67	70	72
Upper Range	88	92	96	100	104	108	112	116	120	125	130	134	139	144

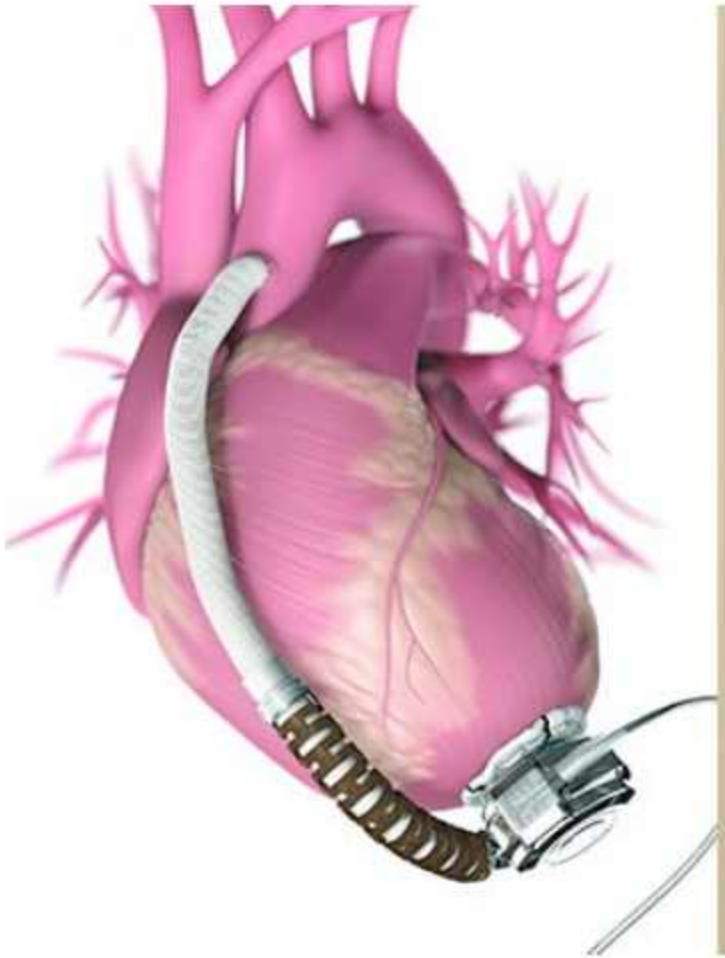
Argument *Against* DT VAD : Down in (Calgary) Flames…

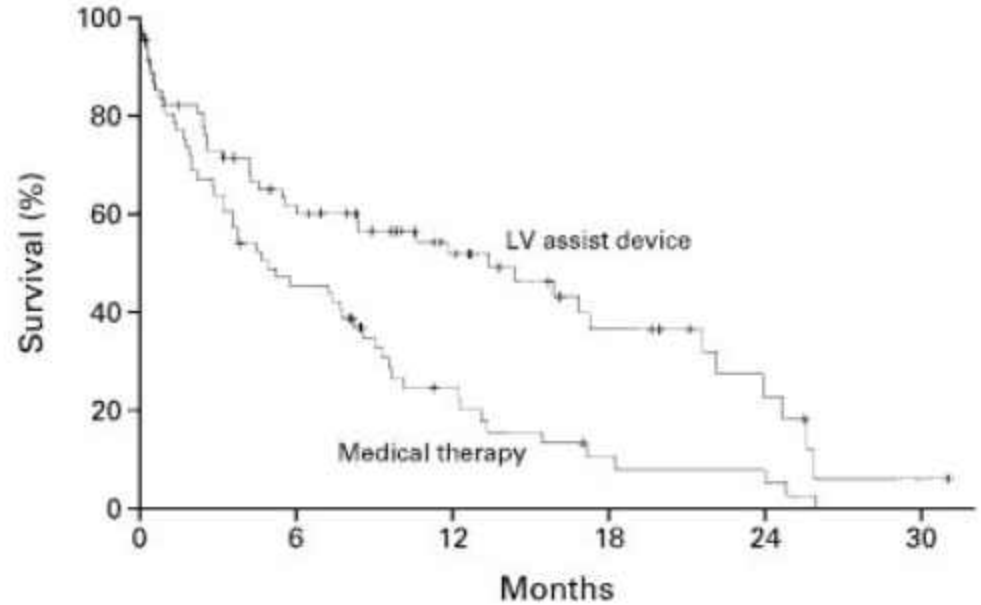
It is Time for Universal Destination LVAD Therapy in Canada?

Really??

Jonathan Howlett

Why we are here…..





No. at Risk						
LV assist device	68	38	22	11	5	1
Medical therapy	61	27	11	4	3	0

Rose et al N Engl J Med 2001;345:1435-1443
left-ventricular-assist-device-lvad-1746162_Final-a3ef52fb00ac4f4a9254e8bb1ed7e1b9

My ‘Yes’ Opponent:

Comes From:
- Barbieland

Traits:
- Good looking
- AHF physician
- Well respected

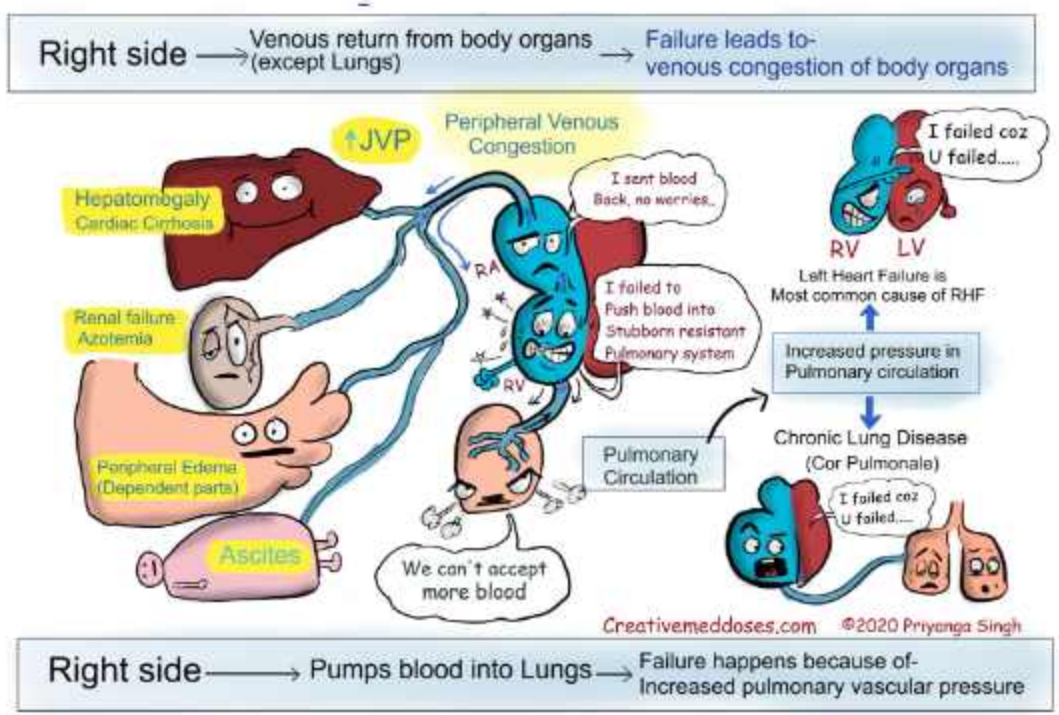
My ‘No’ Self:

Comes From:
- Near Whoville

Traits:
- Ill tempered
- AHF Physician
- Conflict w/MCS providers
- Very experienced

Reasons:
1) High rate of adverse events
2) Lack of differentiation from superior competitor
3) Cost
4) Lack of manpower

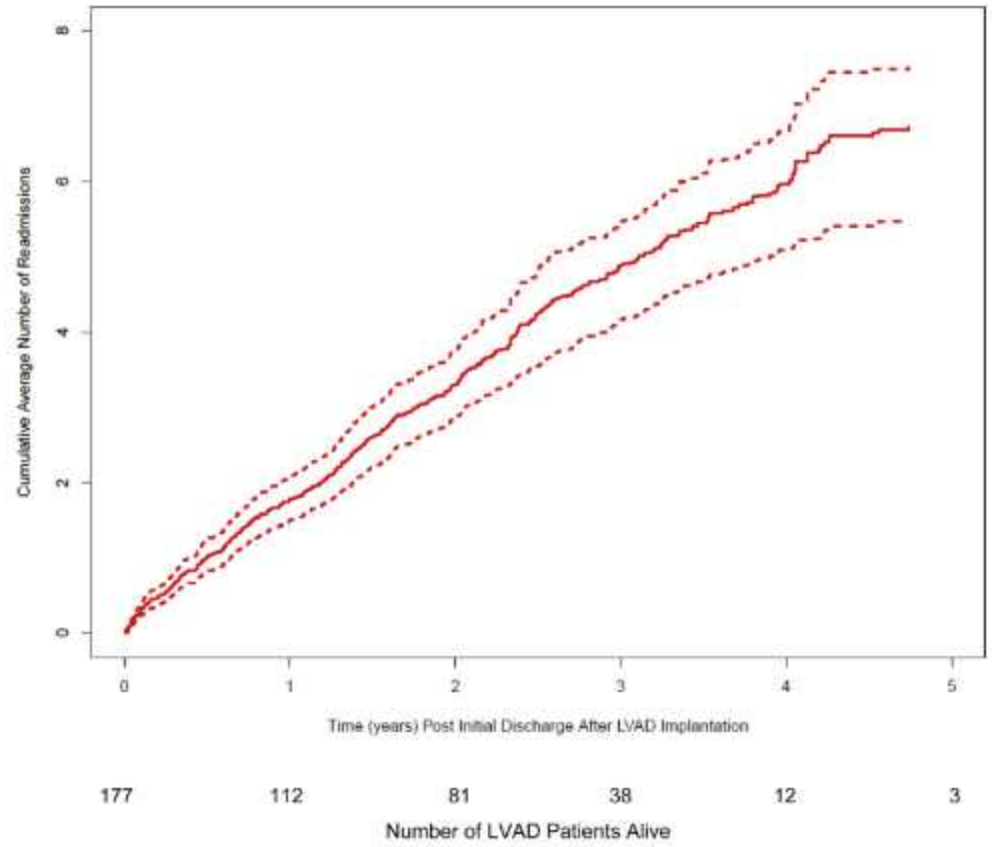
Right Heart Failure – Device Infection

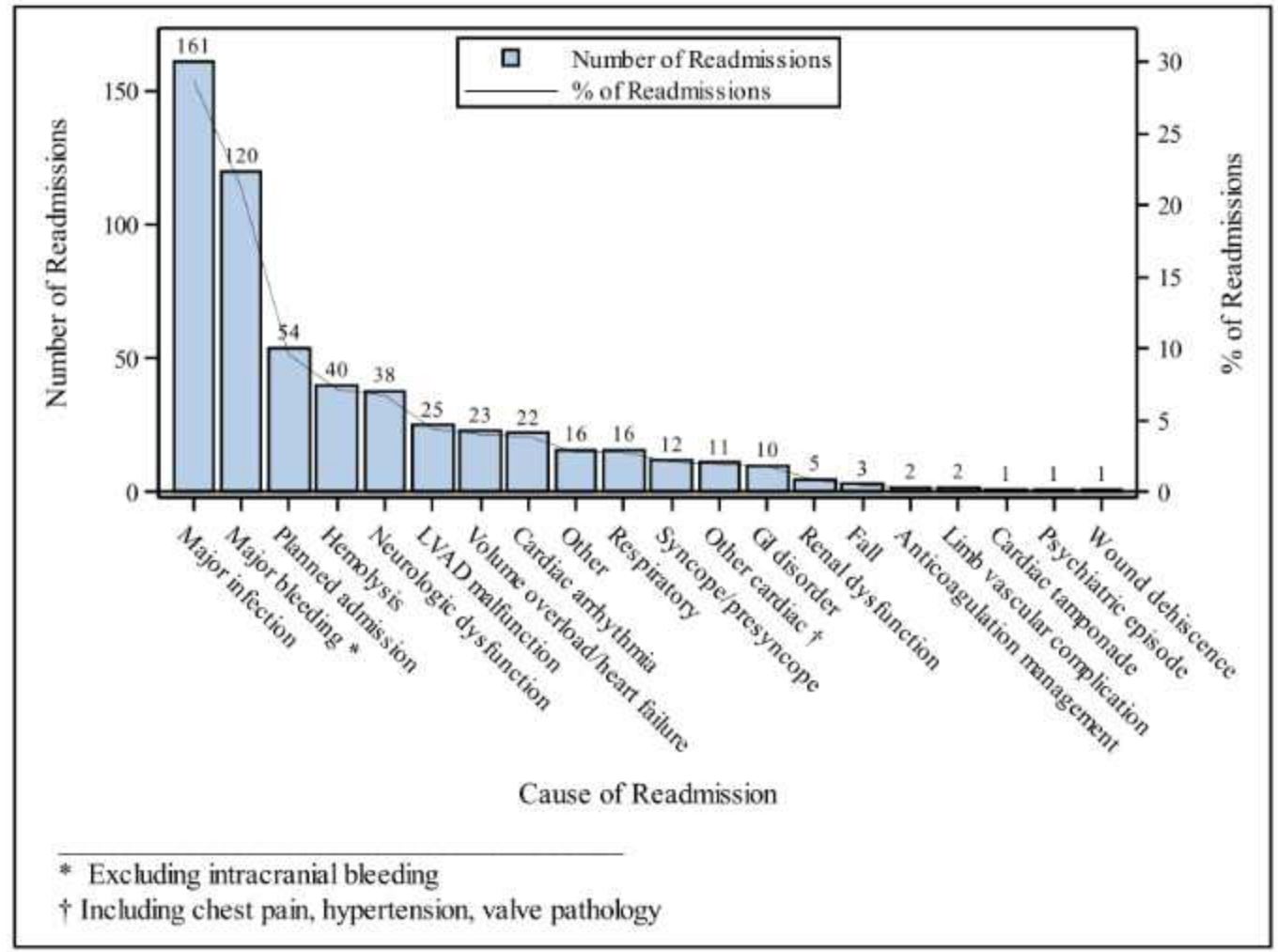


File pictures, LVAD complication, permission granted

Right Heart Failure – Device Infection: GI Bleeding

Sorry…..no picture for this one!!


Cumulative Average Number of Readmissions
0
2
4
6
8
0
1
2
3
4
5
Time (years) Post Initial Discharge After LVAD Implantation
177
112
81
38
12
3
Number of LVAD Patients Alive
Cumulative average number of readmissions
95% pointwise confidence limits


Number of Readmissions
% of Readmissions
Number of Readmissions
% of Readmissions
0
50
100
150
0
5
10
15
20
25
30
161
120
54
40
38
25
23
22
16
16
12
11
10
5
3
2
2
1
1
1
Major infection
Major bleeding *
Planned admission
Hemolysis
Neurologic dysfunction
LVAD malfunction
Volume overload/heart failure
Cardiac arrhythmia
Other
Respiratory
Syncope/presyncope
Other cardiac †
GI disorder
Renal dysfunction
Fall
Anticoagulation management
Limb vascular complication
Cardiac tamponade
Psychiatric episode
Wound dehiscence
Cause of Readmission
* Excluding intracranial bleeding
† Including chest pain, hypertension, valve pathology

A few false starts……

Observational Study > J Am Coll Cardiol. 2015 Oct 20;66(16):1747-1761.
doi: 10.1016/j.jacc.2015.07.075.

Risk Assessment and Comparative Effectiveness of Left Ventricular Assist Device and Medical Management in Ambulatory Heart Failure Patients: Results From the ROADMAP Study

Jerry D Estep [1], Randall C Starling [2], Douglas A Horstmanshof [3], Carmelo A Milano [4], Craig H Selzman [5], Keyur B Shah [6], Matthias Loebe [7], Nader Moazami [2], James W Long [3], Josef Stehlik [5], Vigneshwar Kasirajan [6], Donald C Haas [8], John B O'Connell [9], Andrew J Boyle [10], David J Farrar [9], Joseph G Rogers [4]; ROADMAP Study Investigators

Affiliations + expand

PMID: 26483097 DOI: 10.1016/j.jacc.2015.07.075
Free article

The NHLBI REVIVE-IT study: Understanding its discontinuation in the context of current left ventricular assist device therapy

Francis D Pagani [1], Keith D Aaronson [2], Robert Kormos [3], Douglas L Mann [4], Cathie Spino [2], Neal Jeffries [5], Wendy C Taddei-Peters [5], Donna M Mancini [6], Dennis M McNamara [3], Kathleen L Grady [7], John Gorcsan 3rd [3], Ralph Petrucci [8], Allen S Anderson [7], Henry A Glick [9], Michael A Acker [9], J Eduardo Rame [9], Daniel J Goldstein [10], Salpy V Pamboukian [11], Marissa A Miller [5], J Timothy Baldwin [5]; REVIVE-IT Investigators

Affiliations + expand

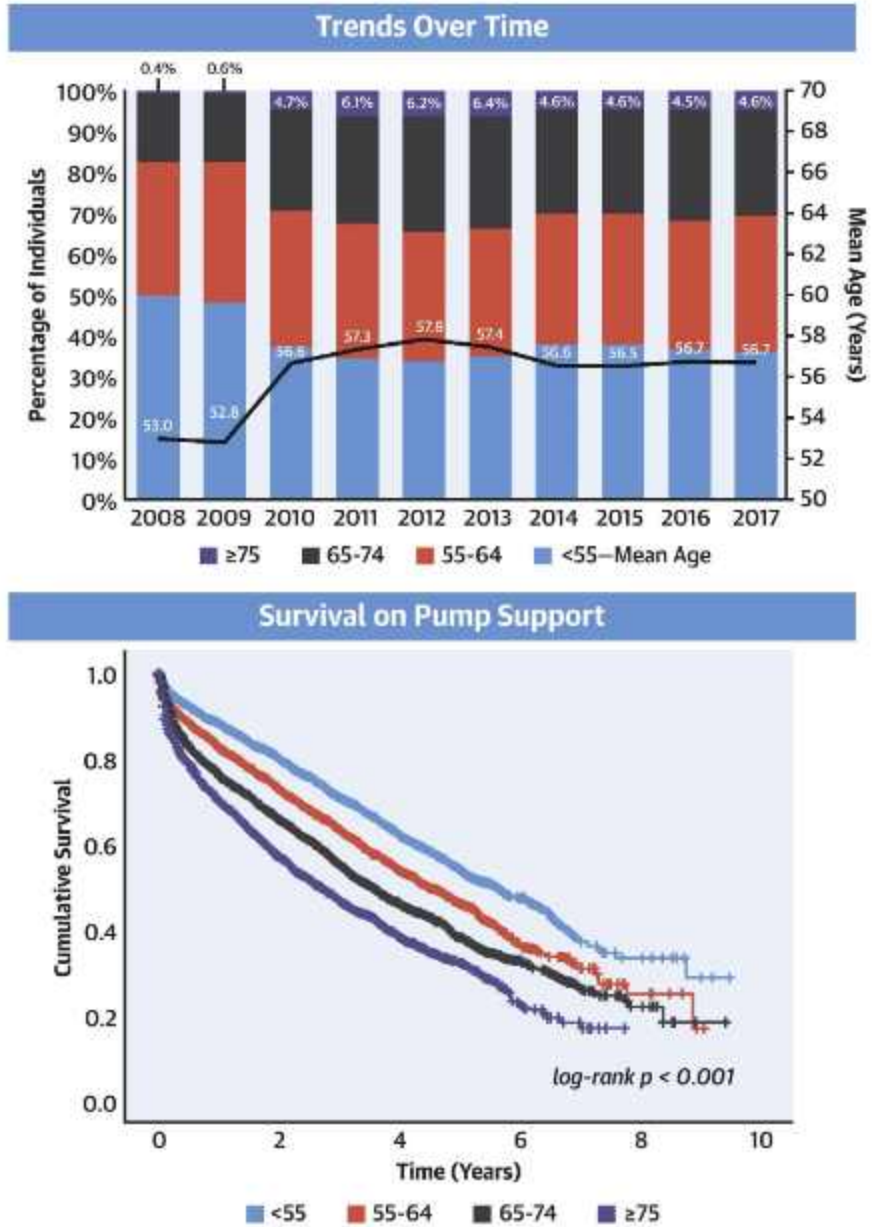
PMID: 27836022 DOI: 10.1016/j.healun.2016.09.002

‘It started with Robbie’: Canada-first procedure a ‘game changer’ for patients waiting on heart transplant

Robbie Sherren donated blood a remarkable 121 times by 40 — the age of his unexpected death. His last, biggest gift marked a first in Canada.

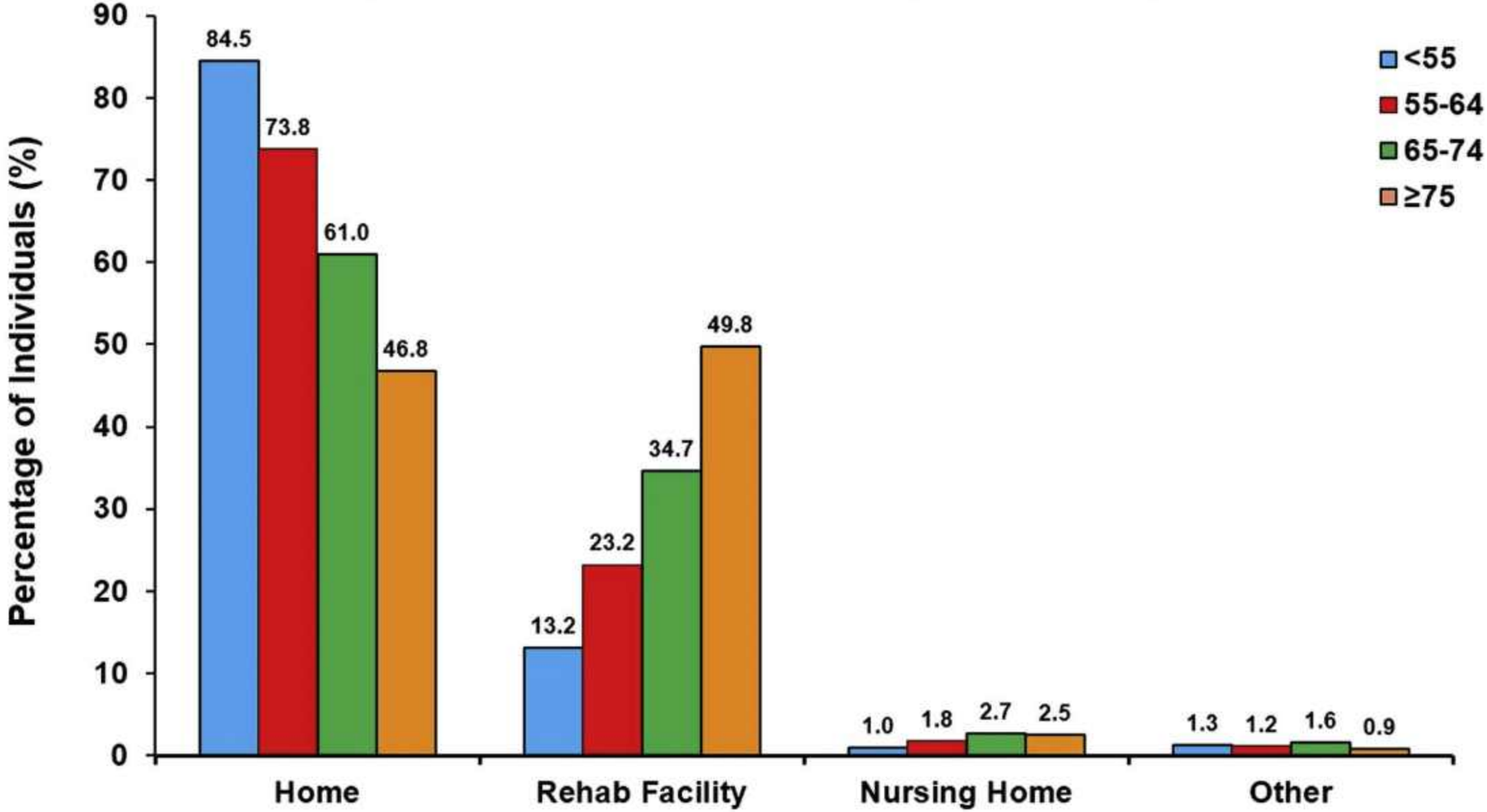
Updated 10 hrs ago | May 19, 2024 | 5 min read (12)

CENTRAL ILLUSTRATION: LVAD Implantation in Older Adults



Caraballo, C. et al. J Am Coll Cardiol HF. 2019;7(12):1069-78.

Discharge Location from Implant Hospitalization by Age



https://doi.org/10.1016/j.jchf.2019.10.004

Then there is the issue of COST…..

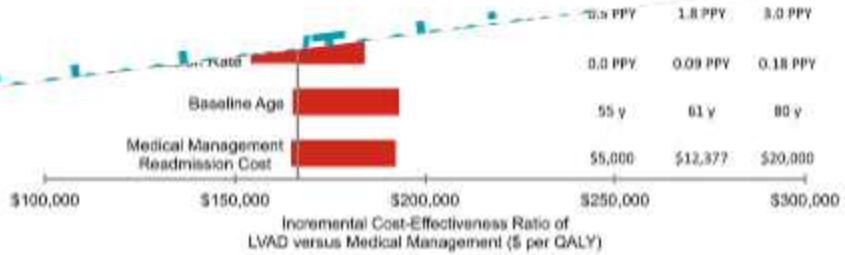
Study	Setting	Cost/QALY (*ICER*)
Shreibeti et al 2016	Destination Therapy (US)	209,400 USD
Chew et al	Destination Therapy (Canada)	230,692 CDN
	DT Optimal Scenario	
INESS		

As of 2013, the Ministry of Health and Long-Term Care provides the following funding for each LVAD patient (Trillium Gift of Life Network written communication, February 19, 2015):

- adult $182,600
- child $223,400

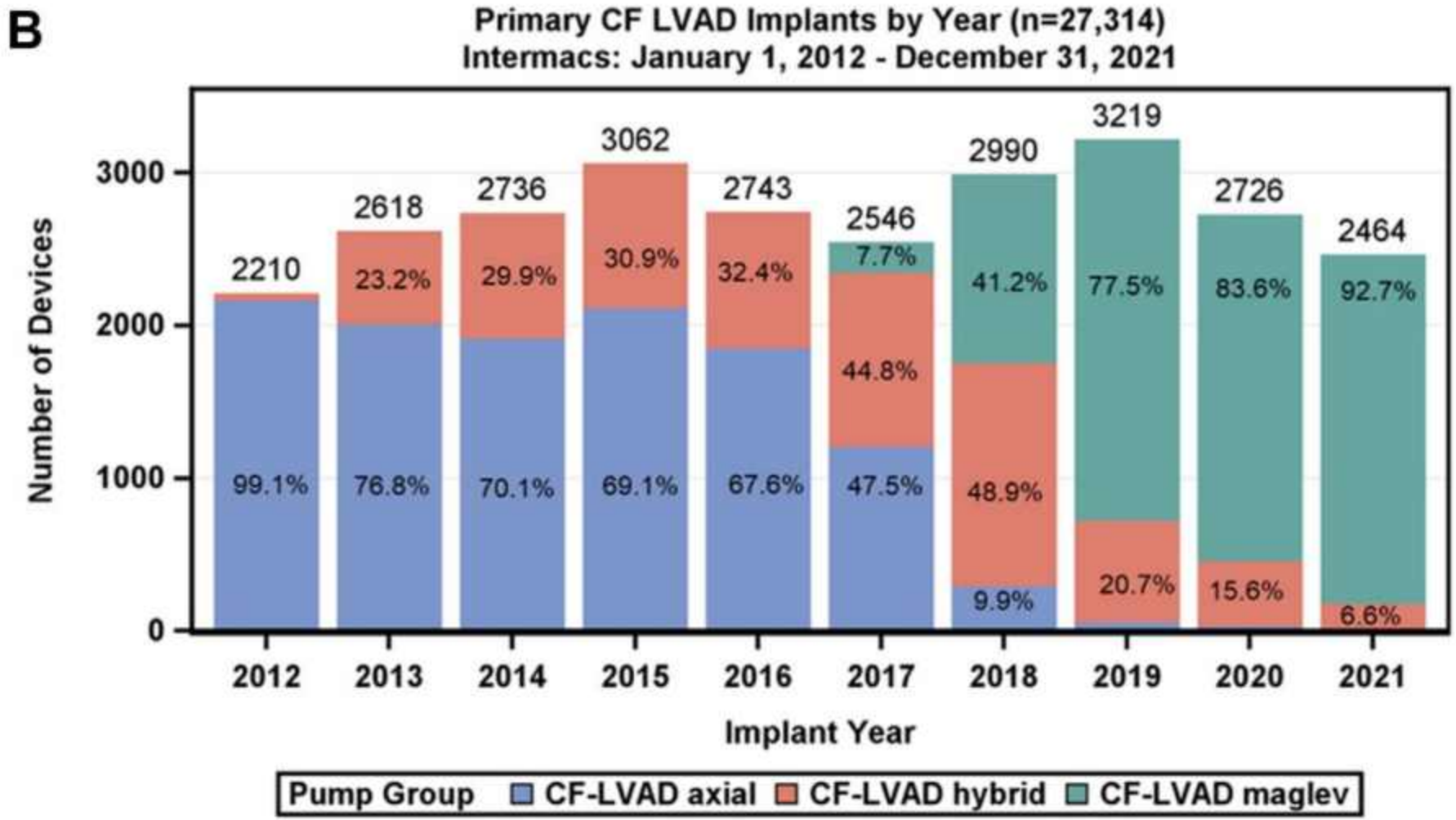
B

						121,200
				2.69	1.84	86,900
	620,900	349,800	271,100	4.41	2.67	1.74	155,800
Medical management readmission increases 0.2 PPY per year, and utility decreases 0.02 per year†	726,200	361,800	364,400	4.41	2.29	2.13	171,100



J Am Coll Cardiol HF 2017;5:110–9
Chew et al, CJC 33 (2017) 1283e1291
https://www.inesss.qc.ca/fileadmin/doc/AETMIS/Rapports/GreffeTransplantation/2000_01_en.pdf

STS 2022 Annual Report: LVAD volumes



LVAD patients enrolled from clinical trials for investigational devices are not included

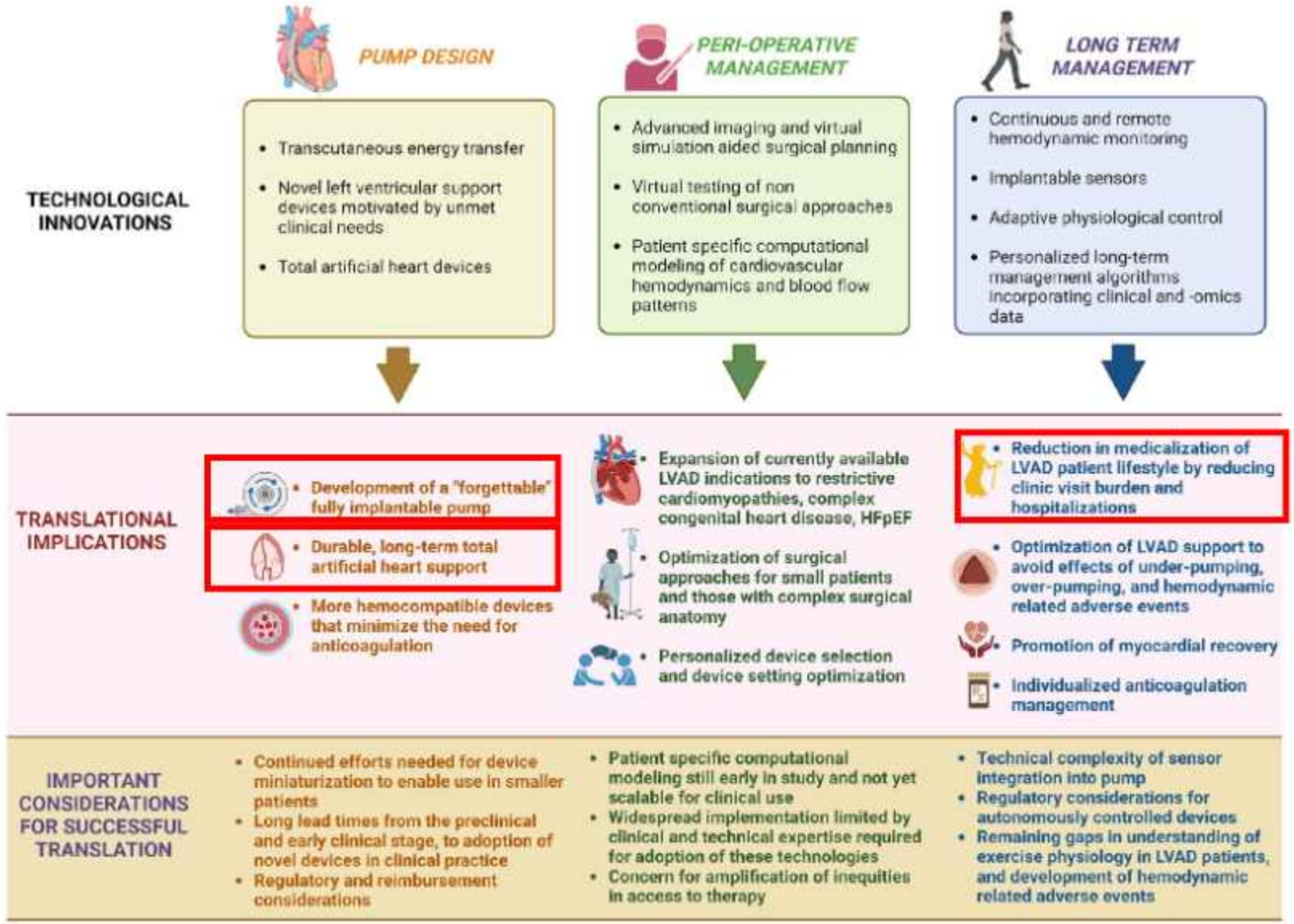
Yuzefpolskaya et al Ann Thorac Surg 2023;115:311-28

Only 13 Centres in Canada Offer LVAD Therapy

Ontario, Canada's best resourced Province inserts At ¼ rate of NY

Cram et a; Circulation: Card Quality and Outcomes Vol13, Issue 1, January 2020

What Must be Done for Universal LVAD Therapy to Grow



Dual, J Card Fail30(2024)596 609

https://www.bing.com/images/search?view=detailV2&ccid=P8i6LTSK&id=2C3F8FB688BA4B207FD87C2F6B813F268E8B7697&thid=OIP.P8i6LTSKdbqqaLWWA3_RgHaD-&mediaurl=https%3a%2f%2fth.bing.com%2fth%2fid%2fR.3fa6bc2d3e4e75baaa95a2e67c0df44f%3frik%3dcGm34CY%252feGaylA%26riu%3dhttp%253a%252f%252fimg2.wikia.nocookie.net%252f__cb20111109003852f%252fchristmasspecials%252fimages%252ff7%252f72%252fHow-the-grinch-stole-christmas-2000-19.jpg%26ehk%3doy1ppk7x24s8jzoNotaH3Vwy9evLsuff7Y%252bZQV0k0o8f%253d%26risl%3df%26pid%3dImgRaw%26r%3d0&exph=686&expw=1280&q=end+of+grinch+movie&simid=607995609845283926&FORM=IRPRST&ck=938C483E8F56498C21D15C5A43CFC7A4&selectedIndex=13&ajaxhist=0&ajaxserp=0

Q&A Period

All panelists

THANK YOU!

Please remember to complete the session evaluation

Next Up! ***Day 2 Highlights from the Co-Chairs*** **and** ***Congress Closing Remarks***

11th ANNUAL HEART FAILURE UPDATE 2024

Nous remercions du fond du **COEUR** *nos commanditaires pour 2024.*

HEART*felt thanks to our 2024 Sponsors*

HFU 24

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Roche

Medtronic

CHFS SCIC Canadian Heart Failure Society / Société canadienne d'insuffisance cardiaque

Le CHFS est affilié à la Société cardiovasculaire du Canada
CHFS is an affiliate society of the Canadian Cardiovascular Society

Co-Chair Highlights
Plenary 3:
The Rainbow Connection

Connexions coeur-rein-métabolisme

Mathieu Bernier, M.D., B. Pharm., FRCPC

Ce qu'on retient :

- A) Dépister la maladie rénale chronique.
- B) En IC, débuter la quadrithérapie tôt et utiliser toutes les opportunités.
- C) Se préparer au raz de marée des AR GLP-1 en indication cardiaque.

Connexion coeur-poumon

Jocelyn Dupuis M.D., Ph. D.

Qu’est-ce qu’on fait?

- Diurèse, optimisation du traitement VG et suivi CLIC.
- KT droit pour évaluer le type d’HTP et instituer un traitement sélectif.
- Investiguer les autres causes HTP: CTEPH, pathol pulmonaire, SAHS.
- On réfère dans un centre HTAP.
- On met un cardioMem.
- On considère mettre un pacemaker sans électrode pour diminuer l’IT et/ou on considère un triclip.

Connexion cœur-cancer

Marwa Soltani, M.D.

Journal of the American Heart Association

Cardiovascular Toxicity Related to Cancer Treatment: A Pragmatic Approach to the American and Eu Guidelines

Joachim Alexandre, MD, PhD*; Jennifer Ca
Joe-Elie Salem, MD, PhD; Fabrice Barl
Mariana Mirabel, MD, PhD; Stéphane Cha
Charles Dolladille, MD; Franck Thuny, M

ESC European Society of Cardiology
European Heart Journal (2022) 00, 1–45
https://doi.org/10.1093/eurheartj/ehac244
ESC GUIDELINES

2022 ESC Guidelines on cardio-oncology developed in collaboration with the European Hematology Association (EHA), the European Society for Therapeutic Radiology and Oncology (ESTRO) and the International Cardio-Oncology Society (IC-OS) Supplementary data

Developed by the task force on cardio-oncology of the European Society of Cardiology (ESC)

ESMO GOOD SCIENCE BETTER MEDICINE BEST PRACTICE

Management of cardiac disease in cancer p treatment: ESMO consensus recommendati

G. Curigliano[1,2†], D. Lenihan[3†], M. Fradley[4], S. Ganatra[5], A. Barac[6], A. Bla
P. Lancellotti[11], A. Patel[12], J. DeCara[13], J. Mitchell[14], E. Harrison[15], J. Mosle
E. de Azambuja[19], J. L. Zamorano[20], R. Krone[21], Z. Iakobishvili[22], J. Carver[23], S. Armenian[24], B. Ky[25], D. Cardinale[26],
C. M. Cipolla[27], S. Dent[28] & K. Jordan[29], on behalf of the ESMO Guidelines Committee*

High-risk genotypes and associated predictors of sudden cardiac death (1)

Gene	Annual SCD rate	Predictors of SCD
LMNA	5–10%	Estimated 5-year risk of life-threatening arrhythmia using LMNA risk score https://lmna-risk-vta.fr
***FLNC*-truncating variants**	5–10%	LGE on CMR LVEF<45%
TMEM43	5–10%	Male Female and any of the following: LVEF <45%, NSVT, LGE on CMR, >200 VE on 24h Holter ECG

ESC

2023 ESC Guidelines for the management of cardiomyopathies
(European Heart Journal; 2023 – doi:10.1093/eurheartj/ehad 194)

High-risk genotypes and associated predictors of sudden cardiac death (2)

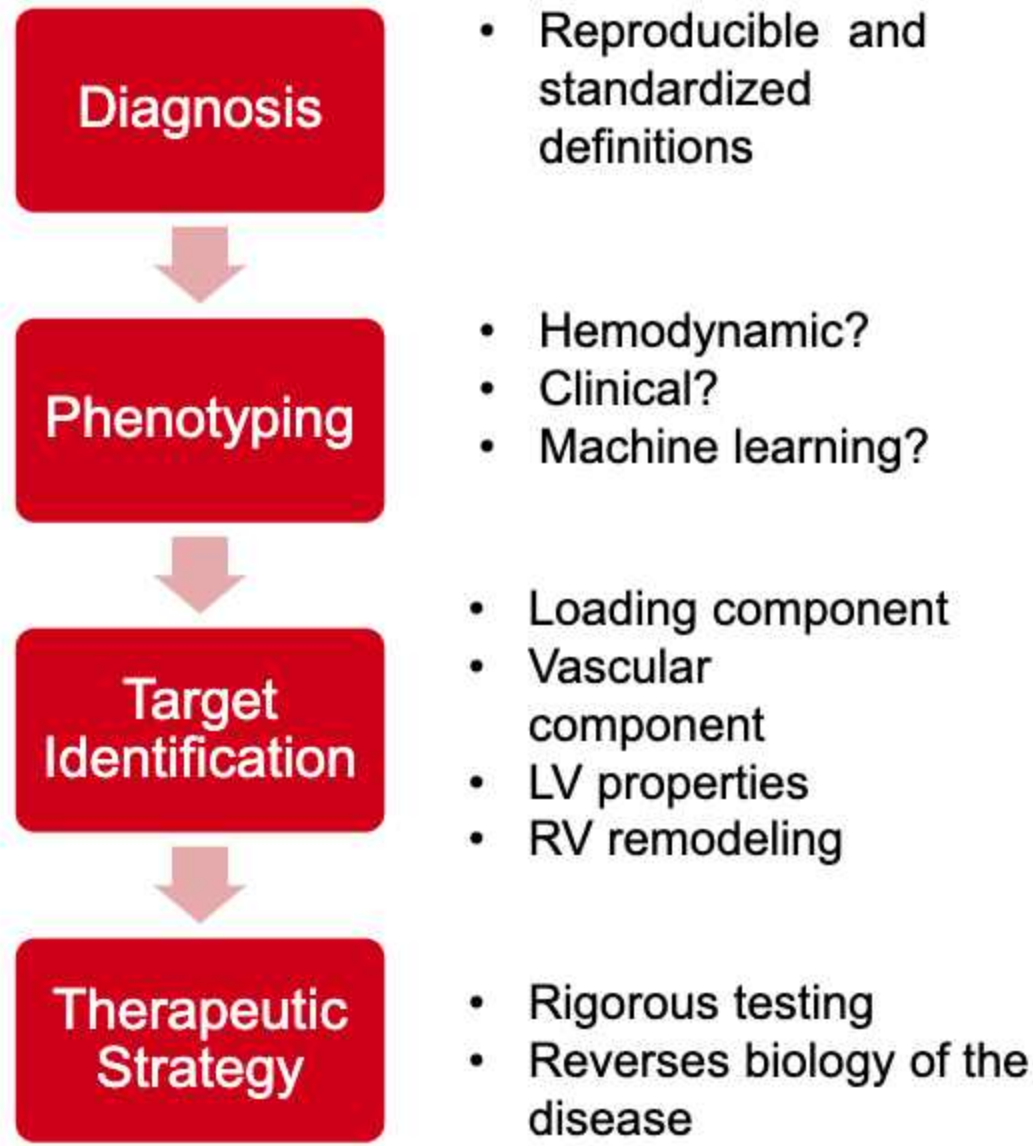
Gene	Annual SCD rate	Predictors of SCD
PLN	3–5%	Estimated 5-year risk of life-threatening arrhythmia using *PLN* risk score https://plnriskcalculator.shinyapps.io/final_shiny LVEF<45% LGE on CMR NSVT
DSP	3–5%	LGE on CMR LVEF<45%
RBM20	3–5%	LGE on CMR LVEF<45%

ESC

2023 ESC Guidelines for the management of cardiomyopathies
(European Heart Journal; 2023 – doi:10.1093/eurheartj/ehad 194)

Summary Thoughts

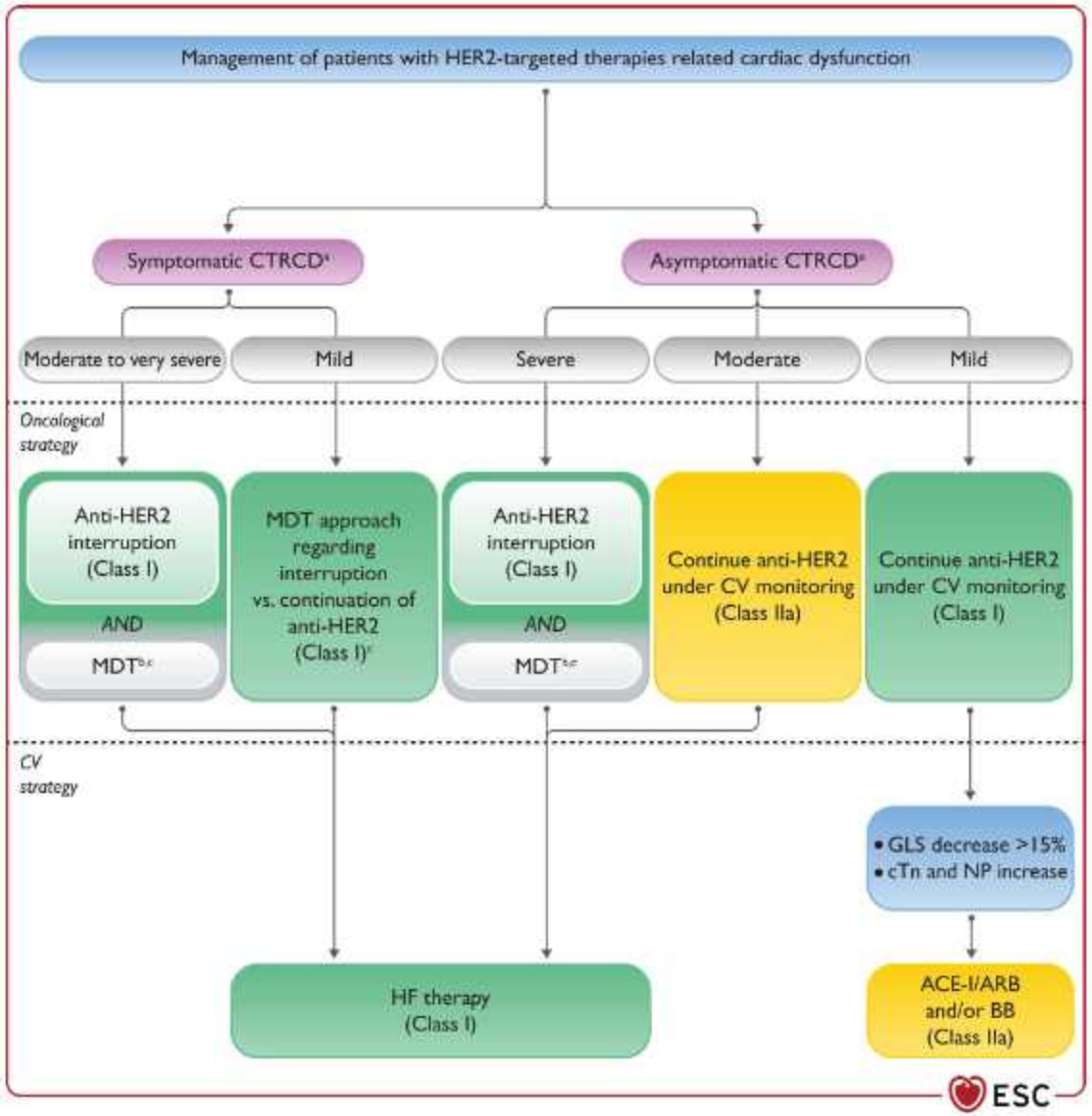
- PH in left heart disease is common, complex and currently lacks a definitive targeted treatment regimen
- PAH therapies should not routinely be used for management
- Optimization of GDMT, left heart therapies critical
- Schemata for future research in PH-LHD needed



KDIGO Heat Map

Prognosis of CKD by GFR and Albuminuria Categories: KDIGO 2012

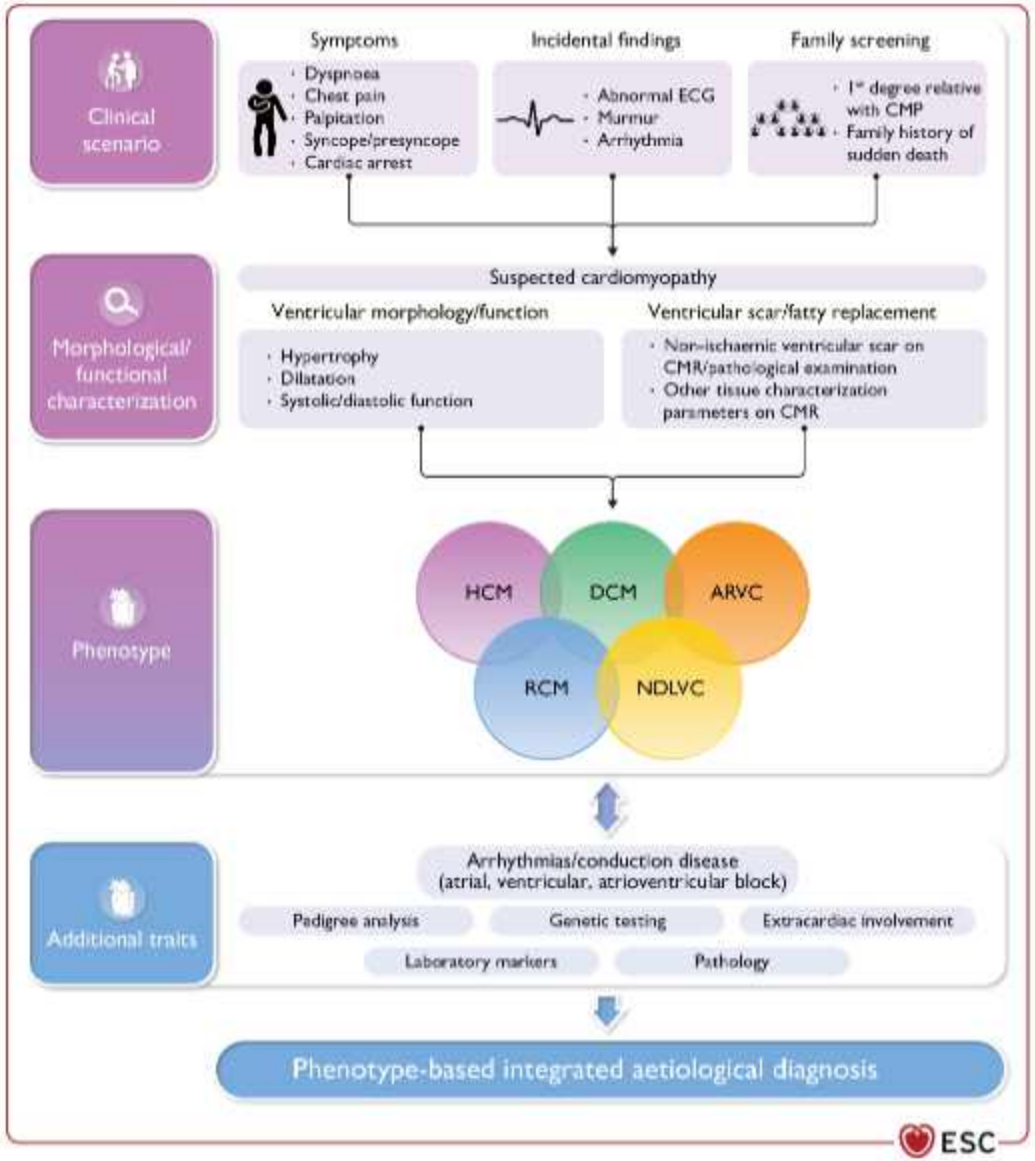
GFR				Albuminuria		
				A1	A2	A3
				Normal to mildly increased	Moderately increased	Severely increased
				< 30 mg/g < 3 mg/mmol	30-300 mg/g 3-30 mg/mmol	> 300 mg/g > 30 mg/mmol
	G1	Normal or high	≥ 90	EMPA-REG, CANVAS, DECLARE		
	G2	Mildly decreased	60-89			CREDENCE DAPA-CKD EMPA-Kidney
	G3a	Mildly to moderately decreased	45-59			CREDENCE DAPA-CKD EMPA-Kidney
	G3b	Moderately to severely decreased	30-44			
	G4	Severely decreased	15-29			
	G5	Kidney failure	< 15			

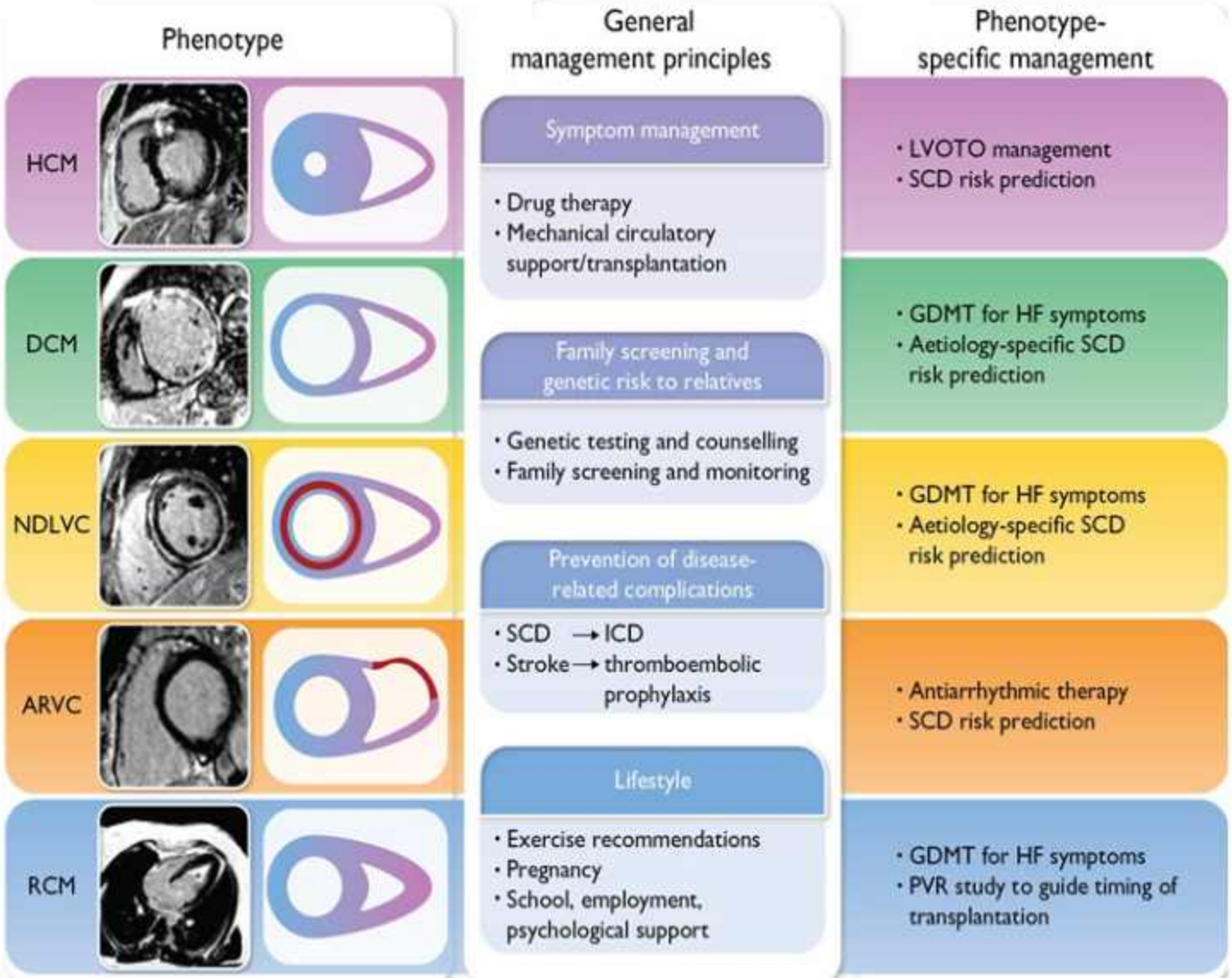


Management of HER2-targeted therapy-related cardiac dysfunction

European Heart Journal, Volume 43, Issue 41, 1 November 2022, Pages 4229–4361

Phenotype-based diagnosis and management





IN: Non-dilated LV Cardiomyopathy

OUT: Takotsubo, LV Non-Compaction

Co-Chair Highlights
Plenary 4:
Hit me With Your Best Shock

UHN/SHS Cardiogenic Shock algorithm and MCS selection

Patient with suspected cardiogenic shock

Defined as:
- Hypotension: sBP <90 mmHg for >30 min or use of vasopressors/inotropes to maintain sBP >90 mmHg OR CI <2.2 L/min/m² **AND**
- Hypoperfusion: evidence of end organ damage (ie.anuria, decreased LOC) or serial lactate rise >2

Exclusion Criteria
- Age >75 years
- Unwitnessed OHCA >30 minutes with unclear neurological status
- Confirmed other cause of shock
- Active bleeding or contraindication for systemic anticoagulation
- Pre-existing chronic condition with prognosis <1 yr

Page the HF staff to activate SHOCK team
Internal (14-3155) or External (CRITICALL)
Shock team members: CVSx, IC, CICU ± MSICU, anesthesia, perfusion

Identify CS phenotype- perform right heart cath
Perform ancillary testing: Labs, ECG, CXR, TTE, LHC, assess vascular anatomy if considering MCS

Ongoing team based management in the critical care unit
- Airway management
- Determine need of MCS
- Titration of vasopressors/inotropes
- Decongestion and/or Initiation of renal replacement therapy
- Initiation of advanced heart failure therapies
- Initiation of goals of care discussion
- Consultation with palliative medicine

REFRACTORY SHOCK despite medical management (SCAI D or E) or post cardiac arrest
CI <2.2 L/min/m² or CPO <0.6

SHOCK TEAM DISCUSSION for MCS
Call anesthesia if going to OR or cath lab

Isolated LV failure
RAP <12, PCWP >15, PAPi> 1.5

Is PaO2 <80?
- YES → VA ECMO
- NO → LV thrombus, mechanical AV or significant AI
  - YES → Surgical centrimag
  - NO → Impella 5.5
    Consider if:
    - Surgical LVAD is not an option
    - Exit strategy or a bridge to recovery

Isolated RV failure
RAP >12, PCWP <15, PAPi <1.5

Is PaO2 <80?
- YES → VA ECMO or Protek Duo or RVAD centrimag
- NO → Protek Duo or RVAD centrimag

Biventricular failure
RAP >12, PCWP >15, PAPi <1.5

Is PaO2 <80?
- YES → VA ECMO
- NO → VA ECMO or BiVAD centrimag

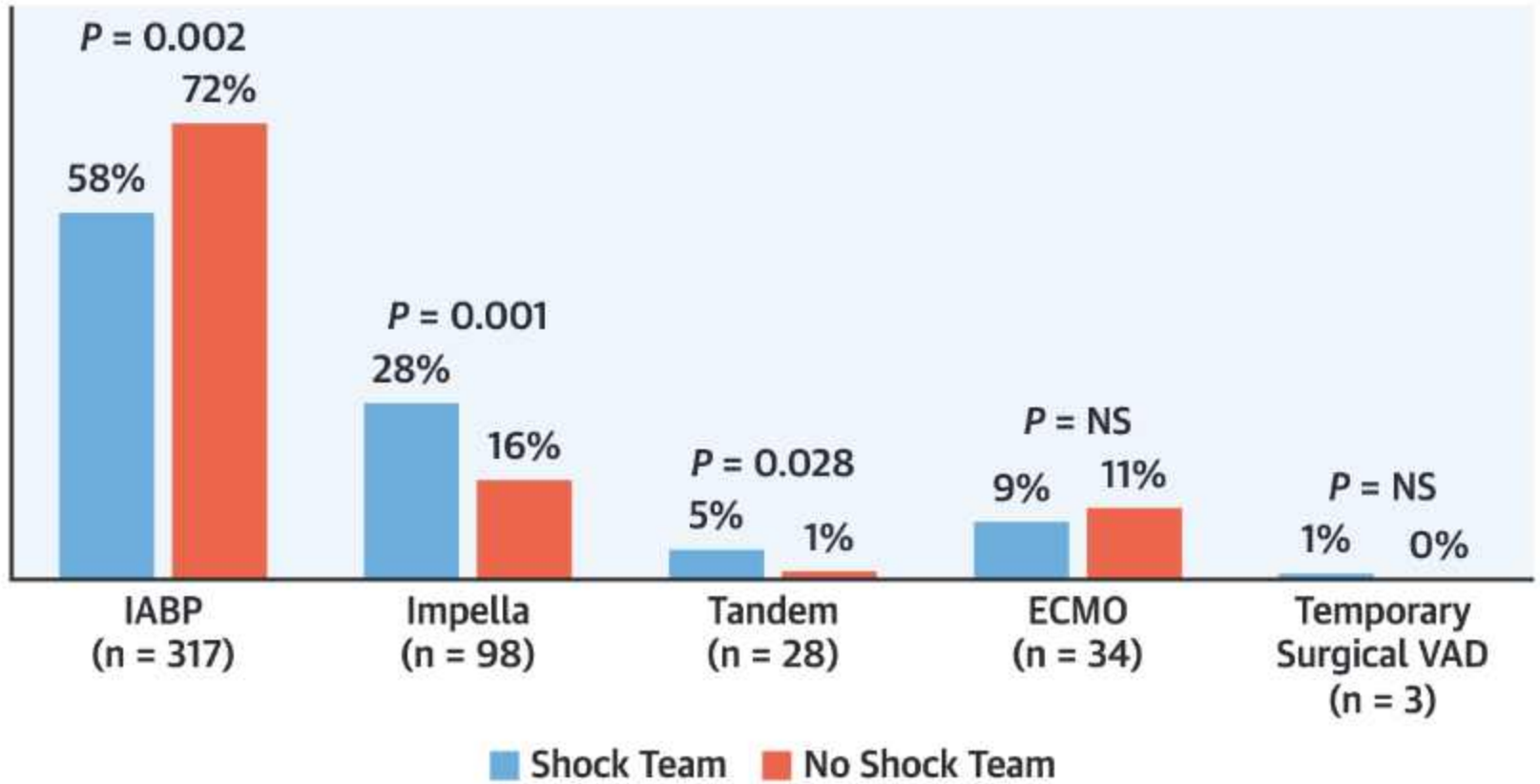
Peripheral VA ECMO: Consider Vent

Clinical considerations:
- No AV opening
- Severe refractory pulmonary edema
- Refractory arrhythmias

Call IC for septostomy
DO not use Impella or IABP

Cardiac power output (CPO)= MAP x CO/451
PAPI: sPAP-dPAP/RAP

Advanced MCS



Papolos et al. *JACC*. 2021

Other Reasons for GDMT in the LVAD Patient