The Robert TV Kung Interventional Heart Failure Fellowship Program
Bringing Hope to the Hopeless at Tufts

Navin K. Kapur, MD, FACC, FSCAI, FAHA
Associate Professor, Department of Medicine
Interventional Cardiology & Advanced Heart Failure Programs
Executive Director, The Cardiovascular Center for Research & Innovation

Tufts Medical Center
The CardioVascular Center

The Acute MCS Working Group

MCRI 20 Molecular Cardiology Research Institute
One Patient’s Interventional Heart Failure Experience

**AMI-Shock**
- **10/2007**
- Anterior MI
- LAD PCI and IABP
- LVEF 20%

**Recurrent HF**
- **11/2007**
- Readmitted Heart Failure
- LVEF 25%
- **11/2007**
- Readmitted - HF ICD Implanted
- LVEF 25%
- **3/2008**
- Readmitted Recurrent HF
- LVEF 25%

**HR-PCI**
- **4/2009**
- Readmitted – HF/ACS
- Impella Supported
- LAD and LCx PCI
- LVEF 25%

**Recurrent HF**
- **7/2012**
- Readmitted Recurrent HF
- LVEF 20%
- **3/2015**
- Readmitted Recurrent HF
- LVEF 20%

**Advanced HF-Shock**
- **12/2017**
- Cardiogenic Shock
- Impella + VA-ECMO
- LVEF 10%
- **12/2017**
- Cardiogenic Shock
- Biventricular Centrimags
- LVEF 10%
- **4/2018**
- Orthotopic Heart Transplant
- LVEF 65%
The Heart Failure Epidemic

By the year 2030, 1:33 individuals in the US will have heart failure.
The Heart Failure Pandemic

From AMI to Ischemic Heart Failure

Heart failure hospitalization
Myocardial infarction mortality

Top 10 Causes of Death Worldwide

Ischaemic heart disease
Stroke
Trachea bronchus, lung
Alzheimer disease and ... COPD
Lower respiratory infections
Colon rectum cancers
Diabetes mellitus
Hypertensive heart disease
Breast cancer


World Health Organization 2012
Heart Attacks Lead to Heart Failure

75% of AMI Patients Treated with Primary Reperfusion Develop Heart Failure Within 5 years

Heart Attacks Lead to Heart Failure

- 76% of patients develop heart failure within 5 years
- 39% of patients die within 5 years

Ezekowitz JA et al JACC 2009
Longitudinal Care for our Cardiovascular Patients
The Tufts Interventional Heart Failure (IHF) Program

Acute MI  
Cardiogenic Shock

High Risk PCI  
Cardiogenic Shock  
Advanced HF (BTD)

Modified from Goodlin. JACC 2009;54:386
Do not attempt PCI in this case without hemodynamic support.
IHF Domain 1: Complex Coronary Revascularization: 50 yo M with LVEF 15% and moderate to severe MR
Advanced HF → Cardiac Surgery → Interventional

Antegrade Dissection Re-entry

Cross-boss

Stingray

Rahban Y (IHF 2017)
Advancing Intra-coronary Imaging
Coronary Optical Coherence Tomography
IHF Domain 2: Valvular Heart Disease
75 yo M with LVEF 25% and severe MR + Porcelain Aorta
Advanced HF → Cardiac Surgery → Interventional

30-50% of HF patients have MR
Optimizing GDMT including CRT
MitraClip – Average 60-70 minutes/case

Kuttab J; Aghili N; Rahban Y (IHF 2015-2017)
IHF Domain 2: Valvular Heart Disease
75 yo M with LVEF 25% and severe MR + Porcelain Aorta
Advanced HF $\rightarrow$ Cardiac Surgery $\rightarrow$ Interventional
IHF Domain 2: Valvular Heart Disease
85 year old with inoperable Aortic Valve Stenosis
Advanced HF $\rightarrow$ Cardiac Surgery $\rightarrow$ Interventional

Andrew Weintraub, MD
IHF Domain 3: Holes in the Heart
Closing holes in the heart to reduce stroke risk
IHF Domain 3: Holes in the Heart
Opening holes to reduce symptoms of heart failure

REDUCE LAP TRIAL
IHF Domain 4: Hypertrophic Cardiomyopathy
Tufts is the Largest HCM Program in the United States

Martin Maron, MD
IHF Domain 5: Mechanical Circulatory Support

2007 - 2017

IVADs

HVAD

Impella CP

BiPellas

5.0 as a Bridge to Recovery
IHF Domain 5: Mechanical Circulatory Support

Bi-VADs
Cardiac Replacement

HVAD

Impella CP
Cardiac Recovery

Bi-Pellas

Delivering patients back to their lives and our neighborhoods
IHF Domain 6: Mechanical Circulatory Support

Catheter-based Approaches for LVAD Failure
IHF Domain 6: Mechanical Circulatory Support

Catheter-based Approaches for LVAD Failure

Outflow Cannula

In Situ Thrombus

Aortic Root

LA or LV Cavity

LV Inflow Cannula

Infusion Line

Fluid-Filled Manometer

Pre-TPA (LV) → Post-TPA (LV)
IHF Domain 7: Advanced Hemodynamics

A

Impella CP: 3.1 LPM

LV Pressure (mmHg)

ON ➔

OFF

B

TandemHeart: 3.1 LPM

LV Pressure (mmHg)

ON ➔

OFF

C

TandemHeart: 4.4 LPM

LV Pressure (mmHg)

ON ➔

OFF

LV Stroke Work

% Reduction in LVSW

Baseline

Infarct

CP (3.1LPM)

TH (3.1LPM)

TH (4.4 LPM)

LV Stroke Volume

Native Stroke Volume (mL)
Effect of elevated pulmonary capillary wedge pressure (PCWP) on pulmonary vascular resistance-compliance relationship (RPA-CPA).

Korabathina and Kapur et al. CCI 2009

IHF Domain 7: Advanced Hemodynamics

\[ \text{PCWP} \uparrow \rightarrow \text{PA Compliance} \downarrow \text{PA Resistance} \]

\[ \text{PAPi} = \frac{\text{PA Pulse Pressure}}{\text{Right Atrial Pressure}} \]
IHF Domain 8: Translational Research

Novel Concept Development

MCRI
BENCH
Basic Science

SIRL
Translational Lab

CVCRI
BEDSIDE
Clinical Science

Discovery to Development
Knowledge to Practice

2015
Clinical Excellence

Preclinical Testing

Fundamental Discoveries

2017
Preclinical DTU Trial
Clinical DTU Trial Launch

Boston
Paris
Rome
Barcelona

IHF Domain 8: Translational Research
The Robert TV Kung Interventional HF Program
Training the Next Generation of IHF Leaders at Tufts MC

- *Funding provided for an ACGME Adv HF Fellow and a Research Fellow per academic year*
The Robert TV Kung Interventional HF Program
Training the Next Generation of IHF Leaders at Tufts MC

Mission Statement:
To advance the training mission of the CVC by providing interventional cardiology fellows with an opportunity to train in advanced heart failure and cardiac transplant medicine, thereby combining technical and cognitive skills to optimize patient care and generate new approaches to clinical research, innovation, and education.
The Robert TV Kung Interventional HF Program
Training the Next Generation of IHF Leaders at Tufts MC

Kung Clinical Fellow (2019)
Kung Clinical Fellow (2020)
Kung Research Fellow (2019)