

Heart Failure: Inpatient Management

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Primary Objectives

1. Epidemiology of Heart Failure
2. Risk Factors and Therapies for Advanced Heart Failure
3. Indications and Types of Ventricular Assist Devices (VAD)
4. Candidate Selection for VAD
5. Selection Criteria for Heart Transplant

Chronic Congestive Heart Failure

The Problem (USA)

- Prevalence: 5,000,000 patients.
- 550,000 new cases CHF each year.
- Incidence x 2 in last ten years.
- 300,000 deaths / year.
- Most frequent reason for hospitalization in patients ≥ 65 years of age.
- 15 million office visits and 6.5 million hospital days each year.
- Rehospitalization within 6 months as high as 50%.
- 5.4% of health care budget (\$38 billion).

Risk Factors for Survival in HF

OLD

NYHA Class

Ejection Fraction

Etiology-ischemic

LVEDD

Hemodynamics

Peak O₂ Consumption

Norepinephrine level

Serum Sodium

NEW

*BUN/Creat/CreatClear.

*Diuretic Dose >1.5 mg/kg/d

*QRS Width >150 msec

*BNP > 1,000

*Can't take ACEI/ARB/BB

***Multiple HF Admissions**

*Hematocrit < 34

More than 3 risk factors warrants referral to Advanced HF Program

Treatment Options for Advanced Heart Failure

1. Medical Management

2. Implantable Cardioverter Defibrillator (ICD) / Biventricular Pacemaker

- ICD - (MADIT II/SCD-HeFT)
- BiV Pacemaker/ICD - (MIRACLE/COMPANION)

3. Surgical Management

- Valve Repair/Replacement; CABG.

4. Mechanical Circulatory Support Devices

- Ventricular Assist Device (VAD)

5. Cardiac Transplantation

- Limited by donor shortage

Inpatient Therapies for Advanced Heart Failure

- Intravenous Diuretics
- Intravenous Vasodilators
 - Nitroglycerin, Nitroprusside, Nesiritide
- Inotropic Agents
 - Milrinone, Dobutamine
- Ultrafiltration

Ventricular Assist Devices (VAD)

- A Mechanical Heart Pump that Provides Circulatory Support to the Failing Ventricle.
- Can Be Used To Support the Right-, Left- or Both Ventricles.

Indications for Ventricular Assist Devices

1. Bridge to Recovery

- Short term support during acute cardiogenic shock or with potentially reversible cases of heart failure.

2. Bridge to Transplantation

- Short to intermediate term support while awaiting transplantation.

3. Destination Therapy

- Long term support as replacement therapy in patients with contraindication to heart transplant.

Bridge to Recovery

Bridge to Recovery

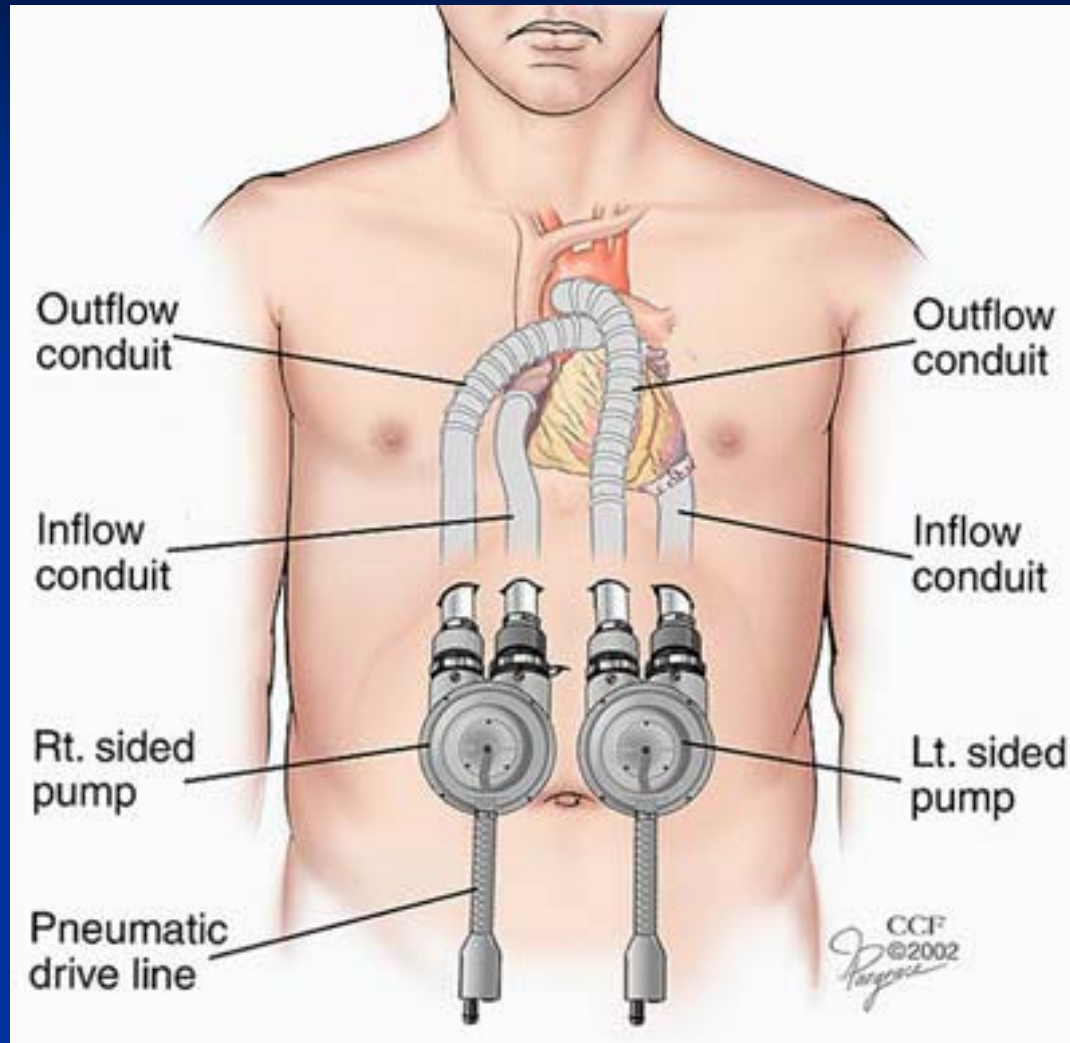
Indications:

1. Cardiogenic Shock following:
 - a) Acute Myocardial Infarction
 - b) Percutaneous Coronary Intervention
 - c) Cardiac Surgery (Post-Cardiotomy)

2. Acute Myocarditis (Viral Cardiomyopathy)

Thoratec pVAD

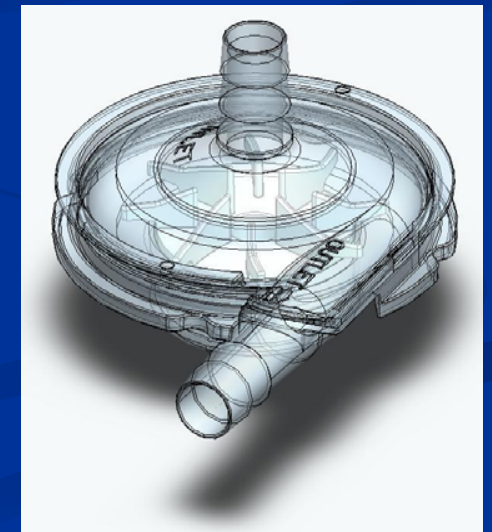
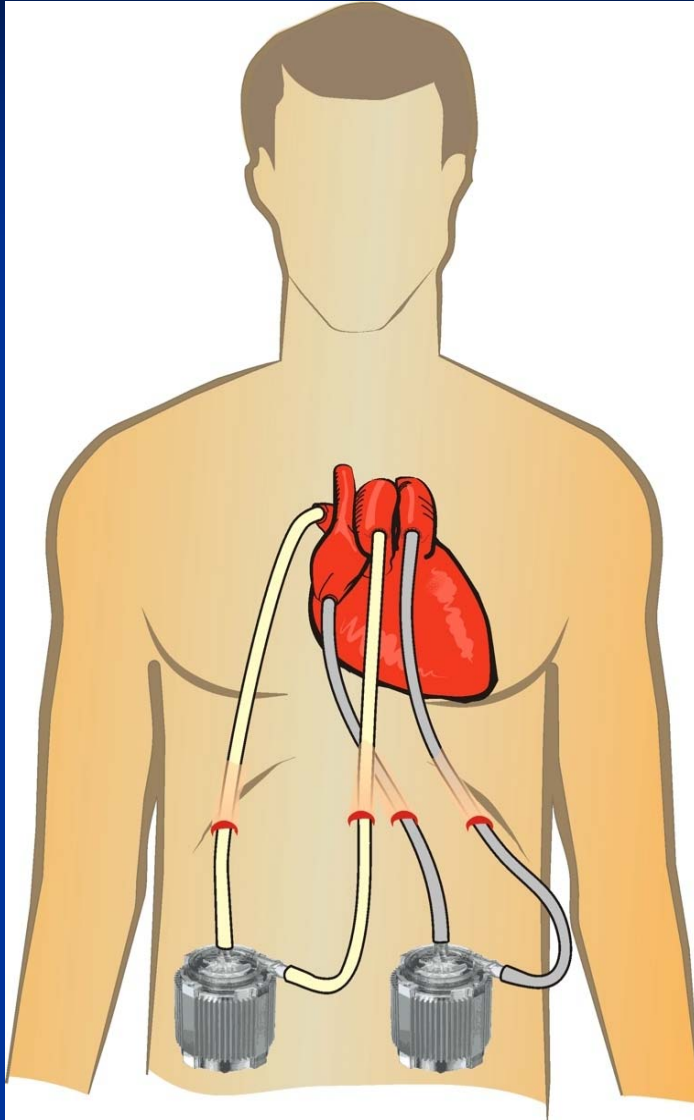
Short Term Devices - Extracorporeal



Pulsatile Pneumatic Pump

CentriMag

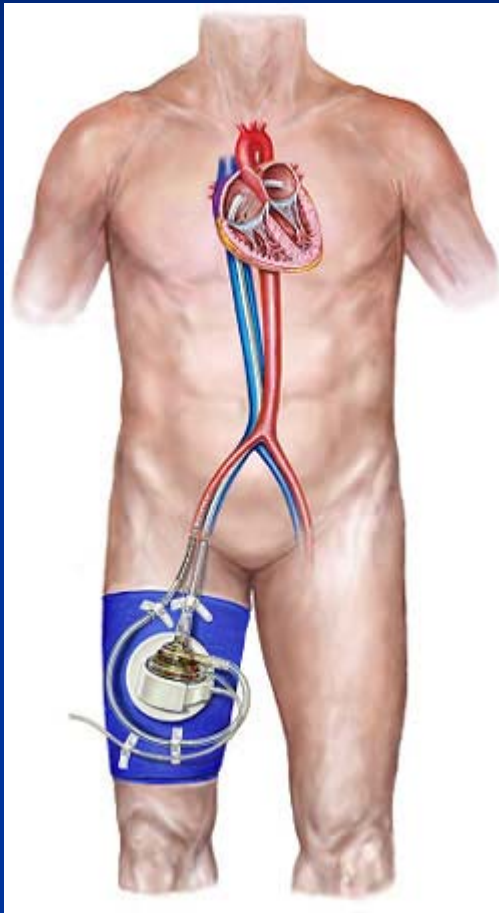
Short Term Devices - Extracorporeal



Continuous Flow, Magnetically Levitated, Centrifugal Pump

TandemHeart pVAD

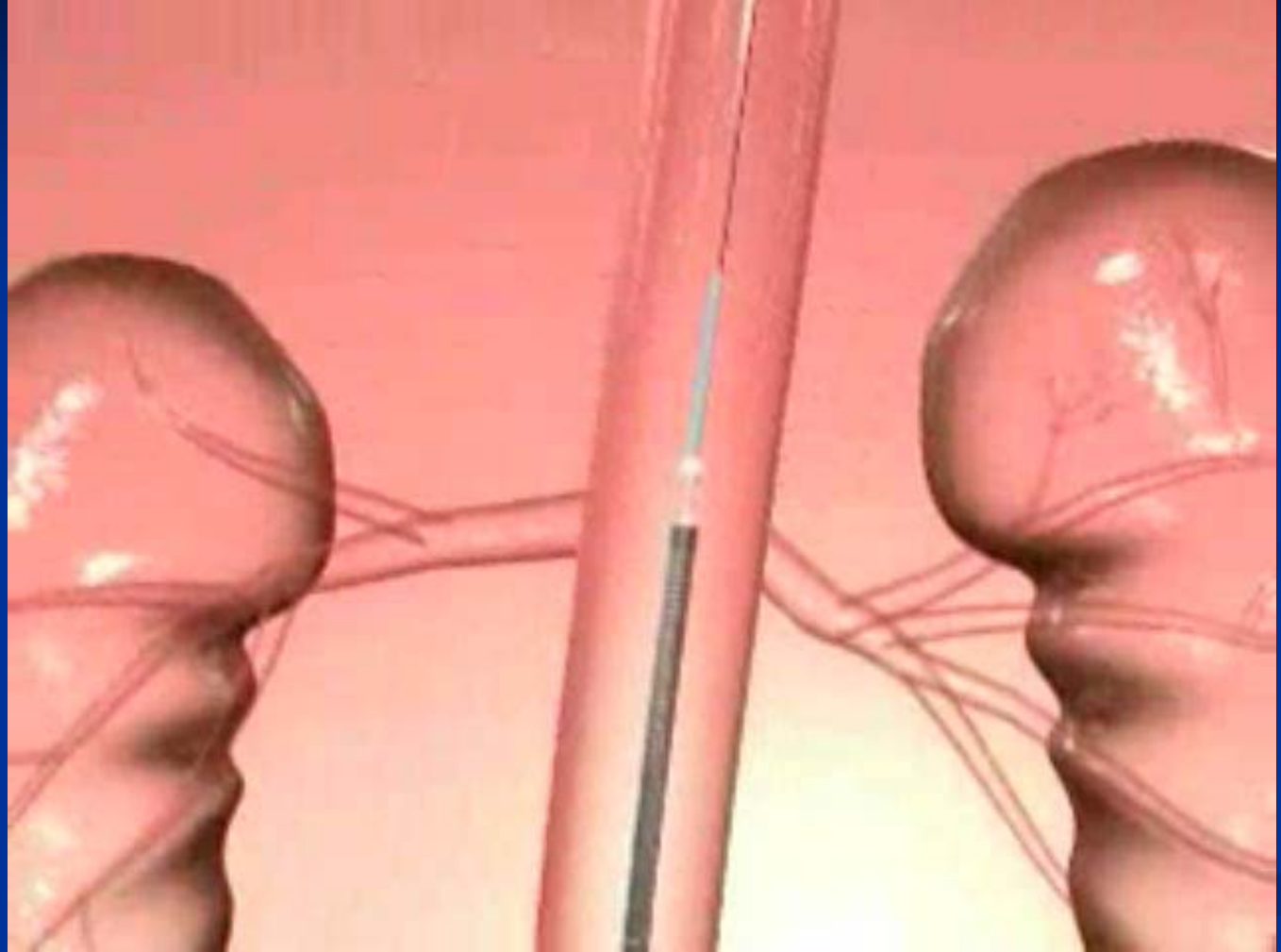
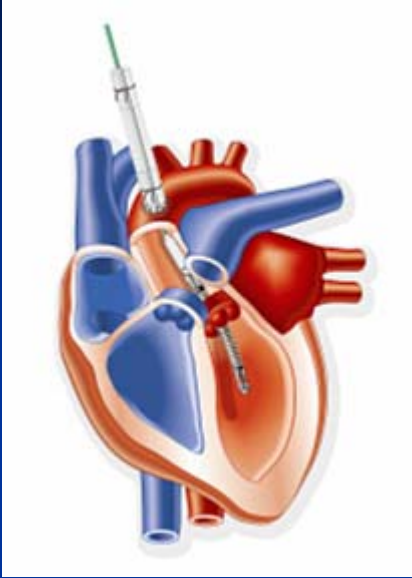
Short Term Devices - Percutaneous



Continuous Flow, Centrifugal Pump

Impella

Short Term Devices - Percutaneous



Continuous Axial Flow Pump

The Five VAD Functional Generations™*

Full Support Ventricular Assist Devices

Only the HeartAssist 5™

has the exclusive flow probe and implants in the pericardial space using a lightweight pump weighing only 92 grams

Generation 5

Exclusive flow probe measures actual blood flow 24/7, and implants in the pericardial space using a lightweight pump <150 grams

Generation 4

Implants above the diaphragm in the pericardial space using a lightweight pump <150 grams

Most full support ventricular assist devices require implanting in the abdominal area, which increases the risk of complications such as bleeding and infection.

Generation 3

Centrifugal Flow

Generation 2

Axial Flow

Gen 1

Large Devices



HeartAssist 5
Exclusive Flow Probe
and Pump

HVAD
145 grams

HeartAssist 5
92 grams

Levacor
440 grams

DuraHeart
540 grams

VentrAssist
298 grams

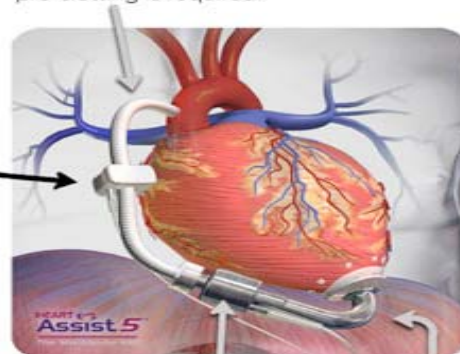
INCOR - 200 grams

HeartMate II - 281 grams

HeartMate XVE
1150 grams

Novacor
1000 grams

The pre-sealed, woven Dacron outflow graft is designed to eliminate leaks. No pre-clotting is required.



The DeBakey HeartAssist 5™ pump weighs only 92 grams, yet provides smooth, gentle blood flow from 1-10 L/min. It is designed to support pediatric patients as small as 0.7 BSA to extra large adults.

The rigid titanium inflow cannula is designed to eliminate twisting and kinking that can restrict blood flow.

HEART Assist 5™

The Modern DeBakey VAD™

MicroMed Cardiovascular
Europe GmbH
Bahnhofstrasse 52
8001 Zurich, Switzerland
Phone: +41 (44) 214 62 49

United States
8965 Interchange Drive
Houston, Texas 77054
Phone: (713) 838-9210
Fax: (713) 838-9214

www.micromedcvc.com

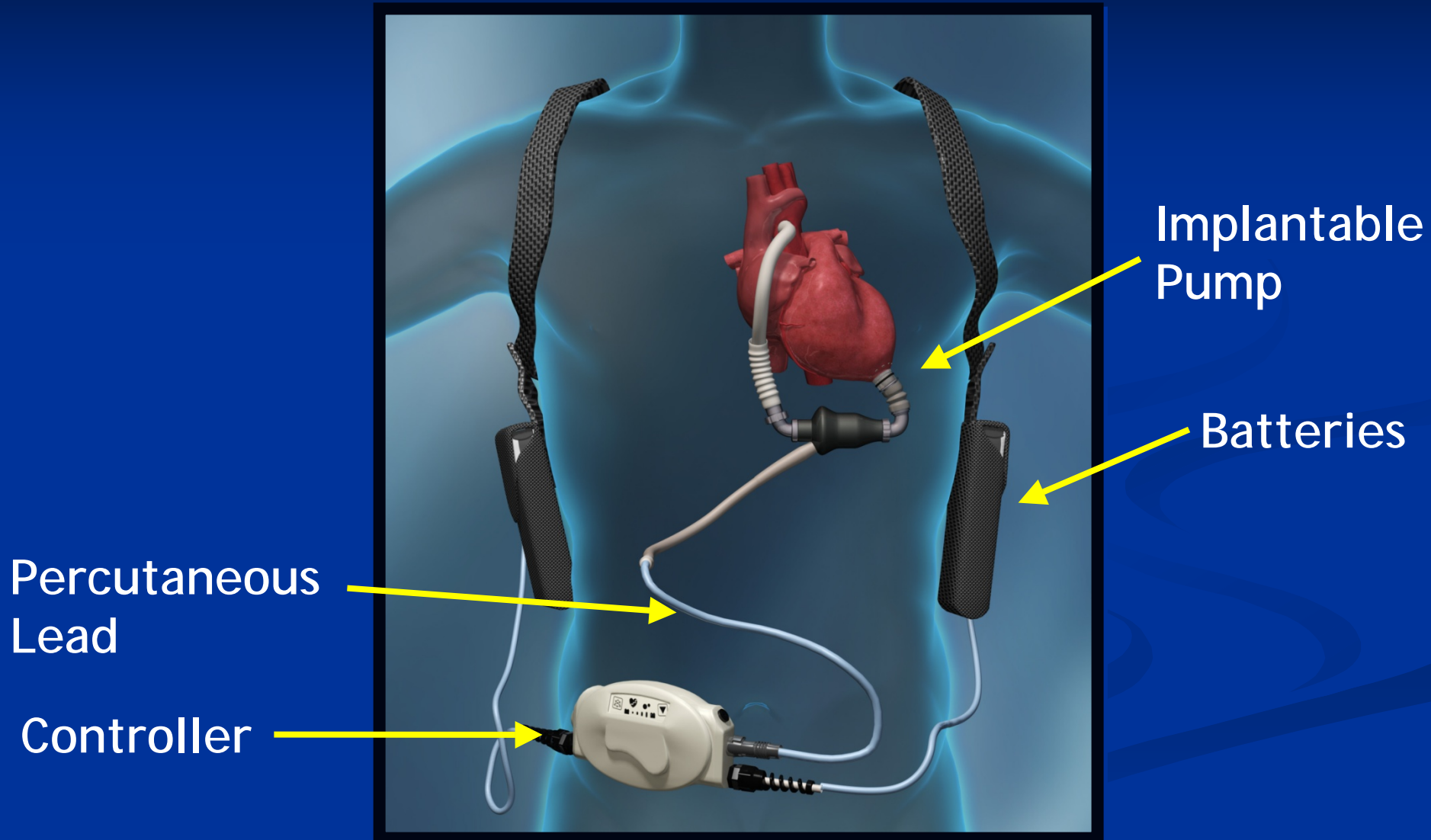
Bridge to Transplant

Bridge to Transplant

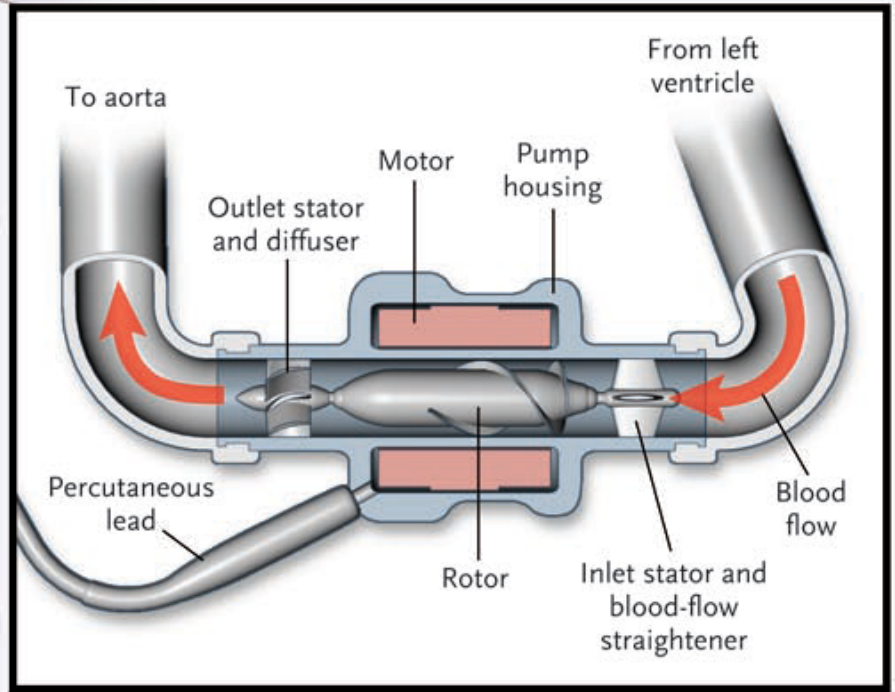
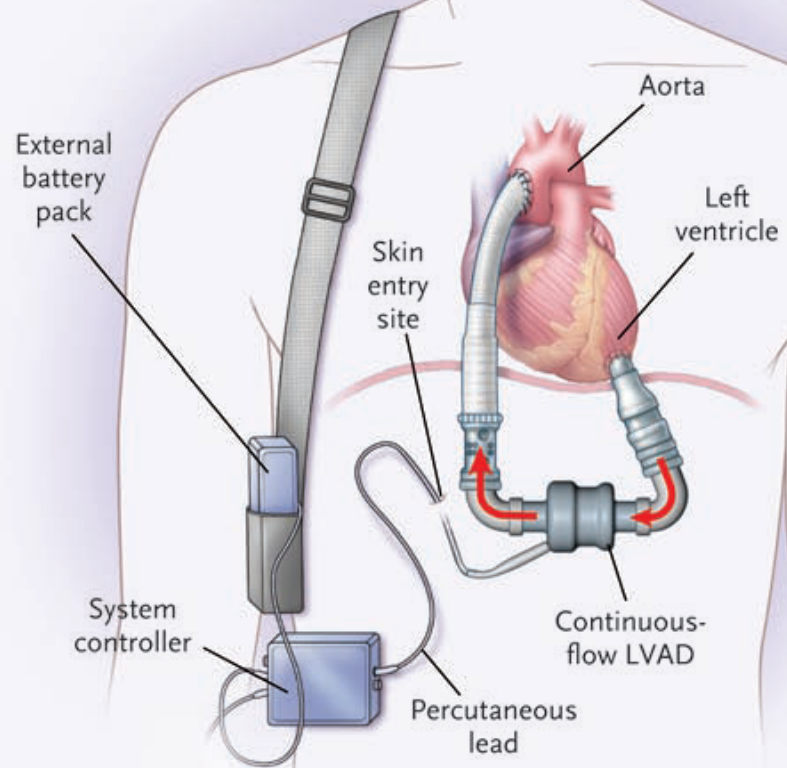
Indications:

1. Active heart transplant candidate.
2. Inotrope dependent with or without intra-aortic balloon pump (IABP).
3. Cardiac index <2.0 L/min/m²
or PCWP >20 mmHg

HeartMate II



Continuous Axial Flow Pump



Destination Therapy

Destination Therapy

Indications:

1. NYHA class IV heart failure refractory to maximal medical therapy including inotropes.
2. Depressed LVEF with poor peak oxygen consumption.
3. Contraindication to transplantation.

Destination Therapy

Indications:

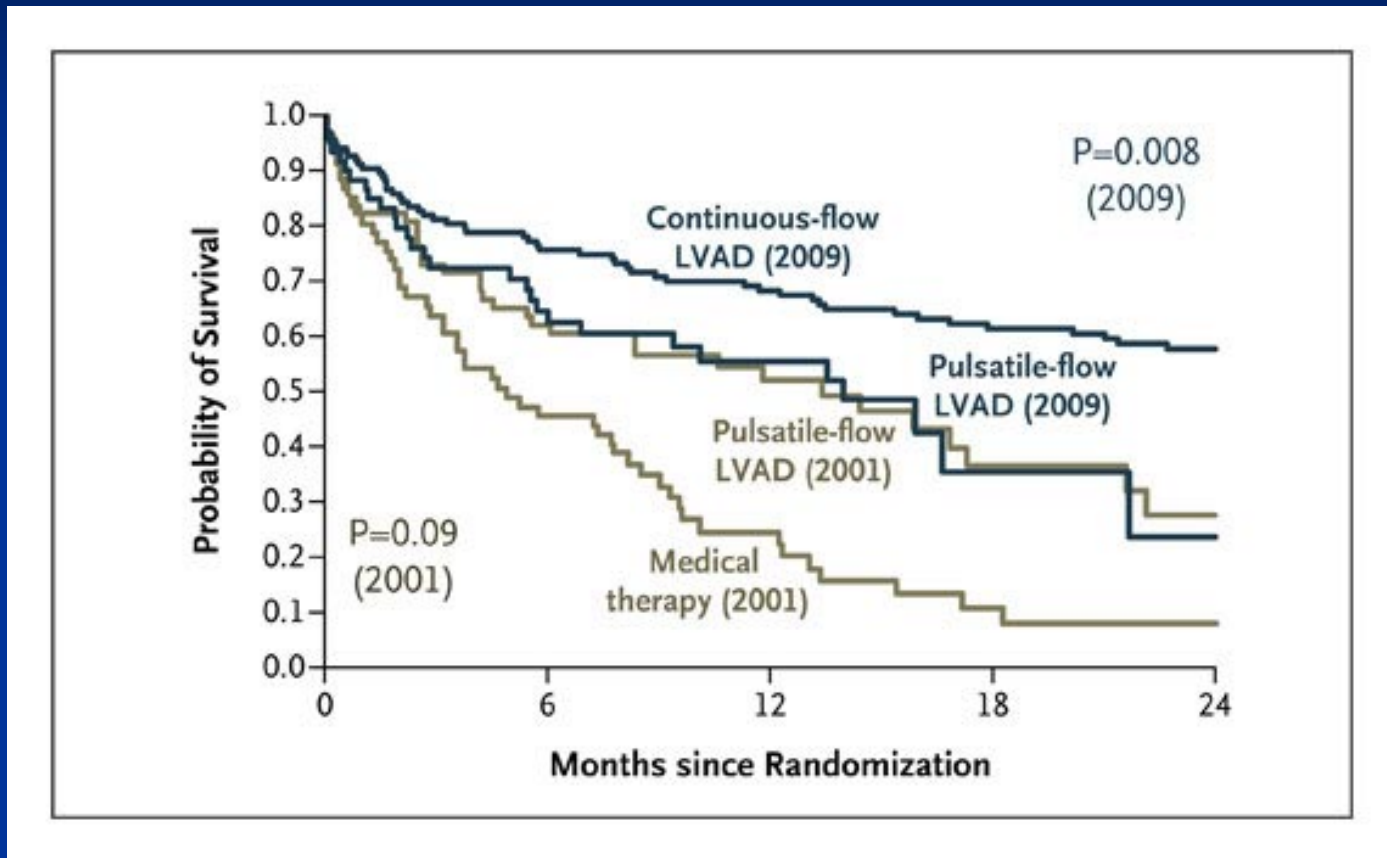
1. NYHA class IV heart failure refractory to maximal medical therapy including inotropes.
2. Depressed LVEF with poor peak oxygen consumption.
3. **Contraindication to transplantation.**

Mechanical Assist Device Program

Advocate Christ Medical Center

- First in the U.S. to Implant a HeartMate II LVAD for Destination Therapy
- One of the Top Five Hospitals in the U.S. for LVAD Surgeries
- First Program in Illinois to Receive Joint Commission VAD Certification (2nd in the U.S.)
- Recipient of Joint Commission CHF Certification

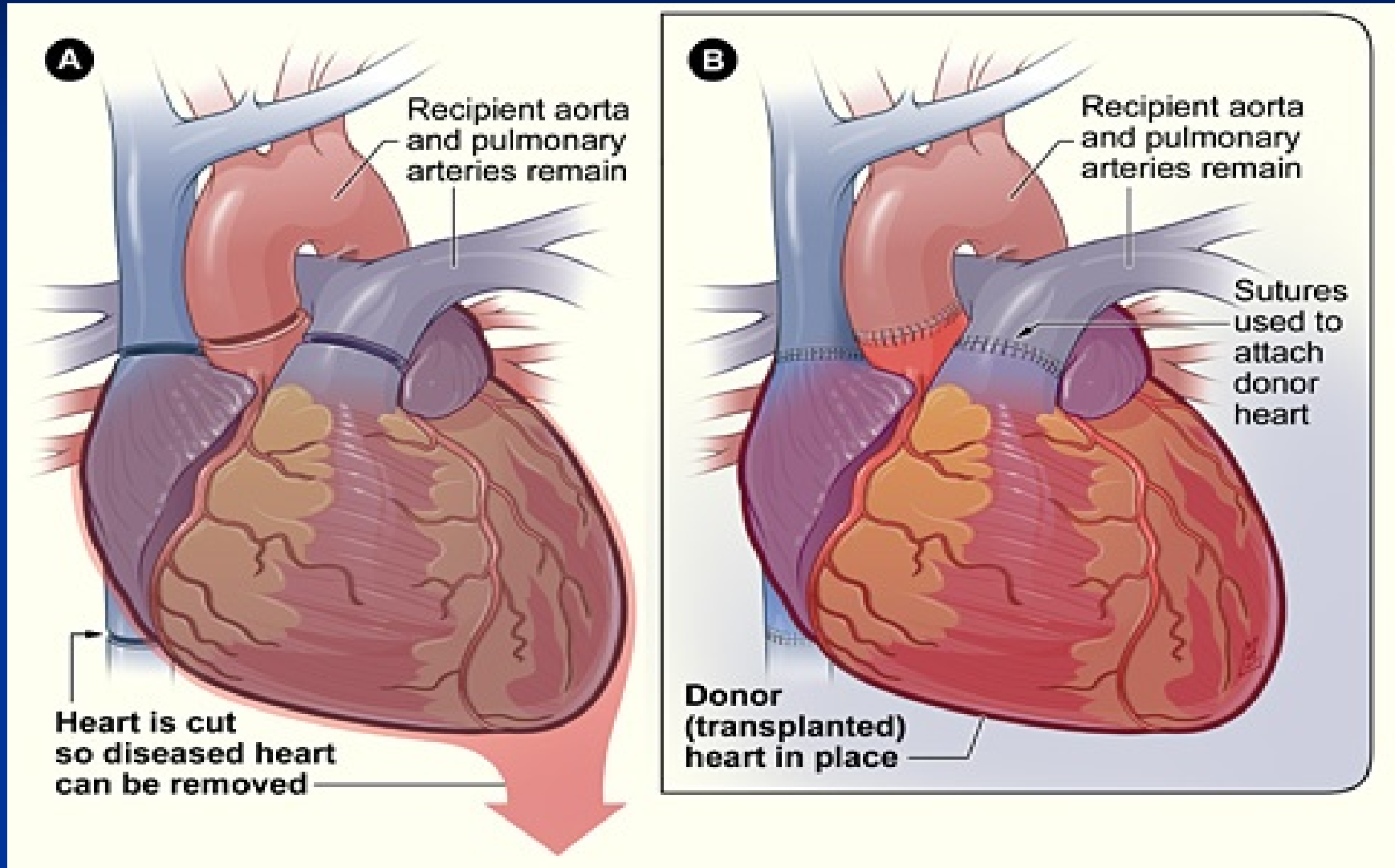
Survival Rates in Two Trials of Left Ventricular Assist Devices (LVADs) as Destination Therapy



Fang J. N Engl J Med 2009;361:2282-2285



Heart Transplantation



Heart Transplantation

Indications

- New York Heart Association Class III-IV heart failure
- Refractory recurrent ventricular arrhythmias
- Refractory recurrent angina not amenable to medical, percutaneous, and/or surgical intervention
- Cardiogenic shock
- Mechanical assistance of a ventilator, intra-aortic balloon pump, ventricular assist device
- Continuous inotropic support/dependence

Relative Contraindications to Cardiac Transplantation

- Obesity (BMI>35)
- Irreversible Pulmonary Hypertension
- Diabetes with End-Organ Damage
- Renal Dysfunction
- Peripheral Vascular Disease

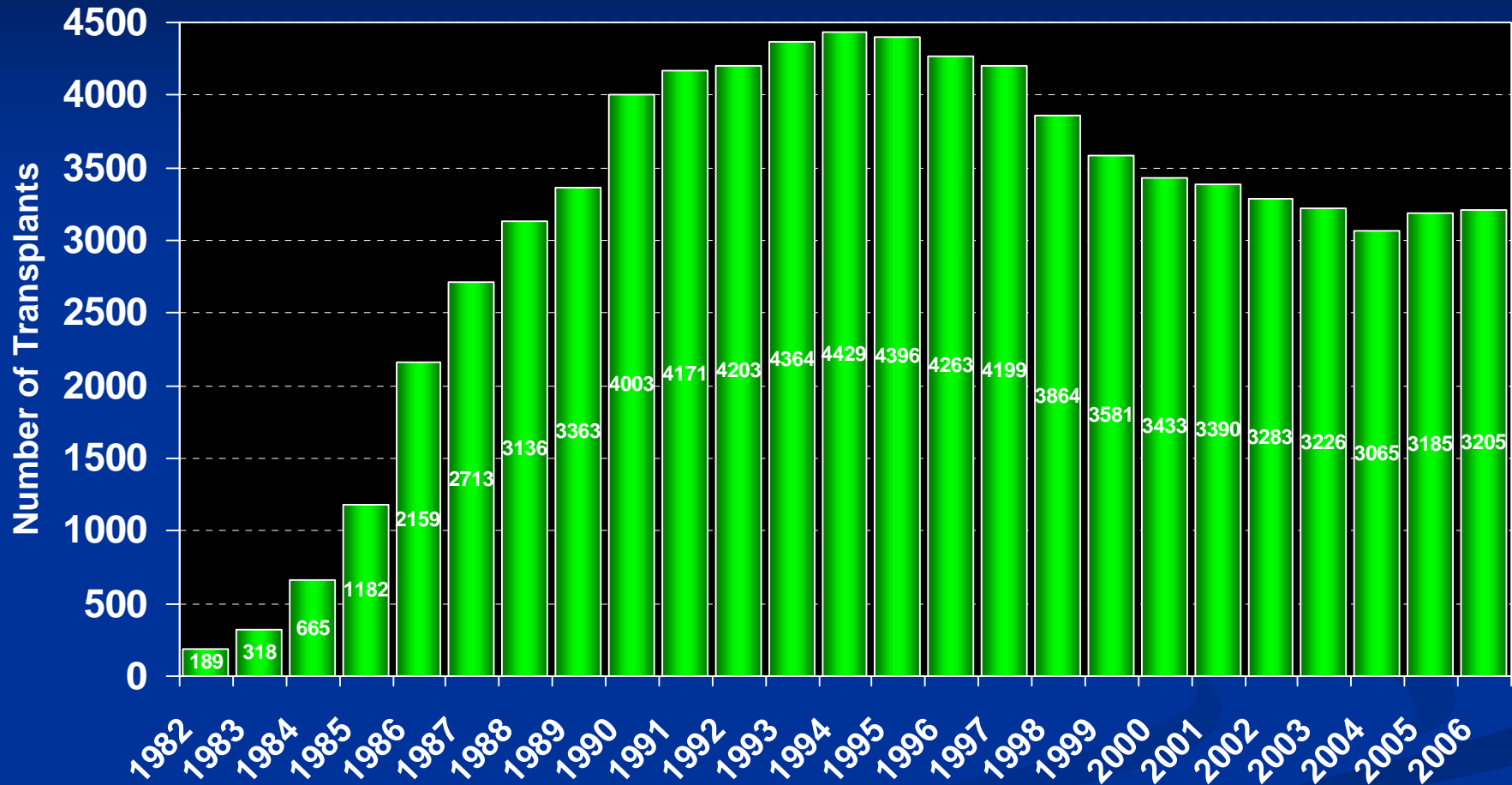
Relative Contraindications to Cardiac Transplantation

- Malignancy
- Active Substance Abuse
- Presence of a Psychiatric Disorder that Would Compromise Adherence to Medical Therapy
- Poor Social Support/Psychosocial Instability
- Severe CNS disease

Whom to Refer for Transplantation

- Age < 70 y/o
- End-Stage Cardiac Disease (NYHA Class III or IV) as a Result of Poor Cardiac Function or Uncontrollable Ventricular Arrhythmias Refractory to Medical Treatment
- Repeated Hospitalizations for Heart Failure
- Strong Social Support
- No Active Drug or Alcohol Abuse

NUMBER OF HEART TRANSPLANTS REPORTED BY YEAR



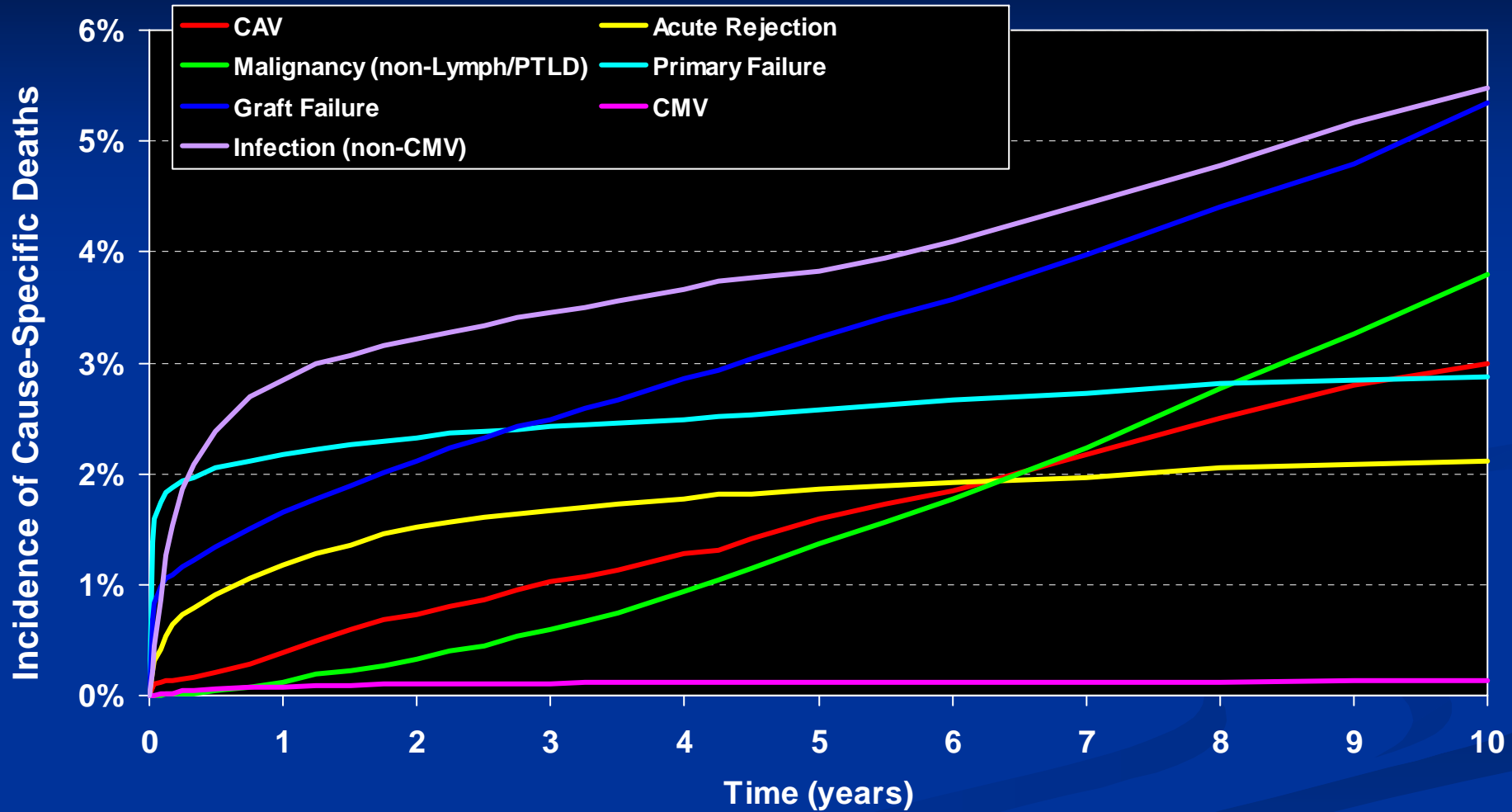
ISHLT

2008

NOTE: This figure includes only the heart transplants that are reported to the ISHLT Transplant Registry. As such, this should not be construed as evidence that the number of hearts transplanted worldwide has declined in recent years.

ADULT HEART TRANSPLANT RECIPIENTS: Cumulative Incidence of Leading Causes of Death

(Transplants: January 1992 - June 2005)

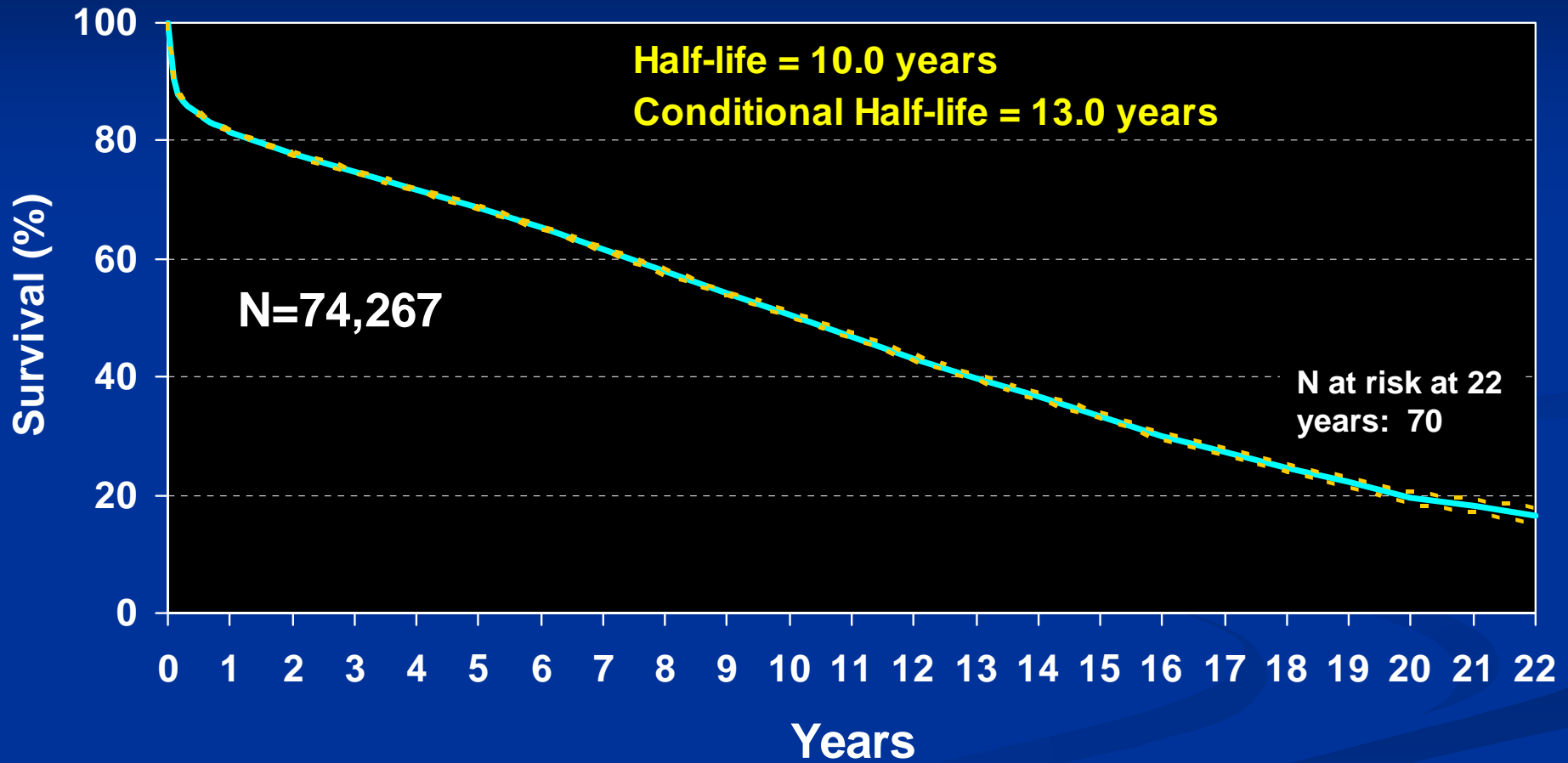


ISHLT

2008

HEART TRANSPLANTATION

Kaplan-Meier Survival (1/1982-6/2006)



ISHLT

2008

J Heart Lung Transplant 2008;27: 937-983

Heart Transplant/VAD Team

- **Referring Physician**
- **Local Hospital/First Responders**
- Cardiothoracic Surgeon
- Transplant/VAD Cardiologist
- Transplant/VAD Nurse Coordinators
- Bioengineering Support
- Medical Support (Nephrology, Pulmonary, Endocrinology, GI, ID...)
- Nutrition, Social Work, Financial Counselor
- Rehab Therapy (Physical, Occupational)
- Pharmacy

Options for Management of Advanced/End Stage HF

Optimized Drug Rx

Surgery

BiV Pacemaker/ AICD



Advanced Rx



BTT



LVAD

Transplant



DT

BTR

