

Advanced Heart Failure: What next?



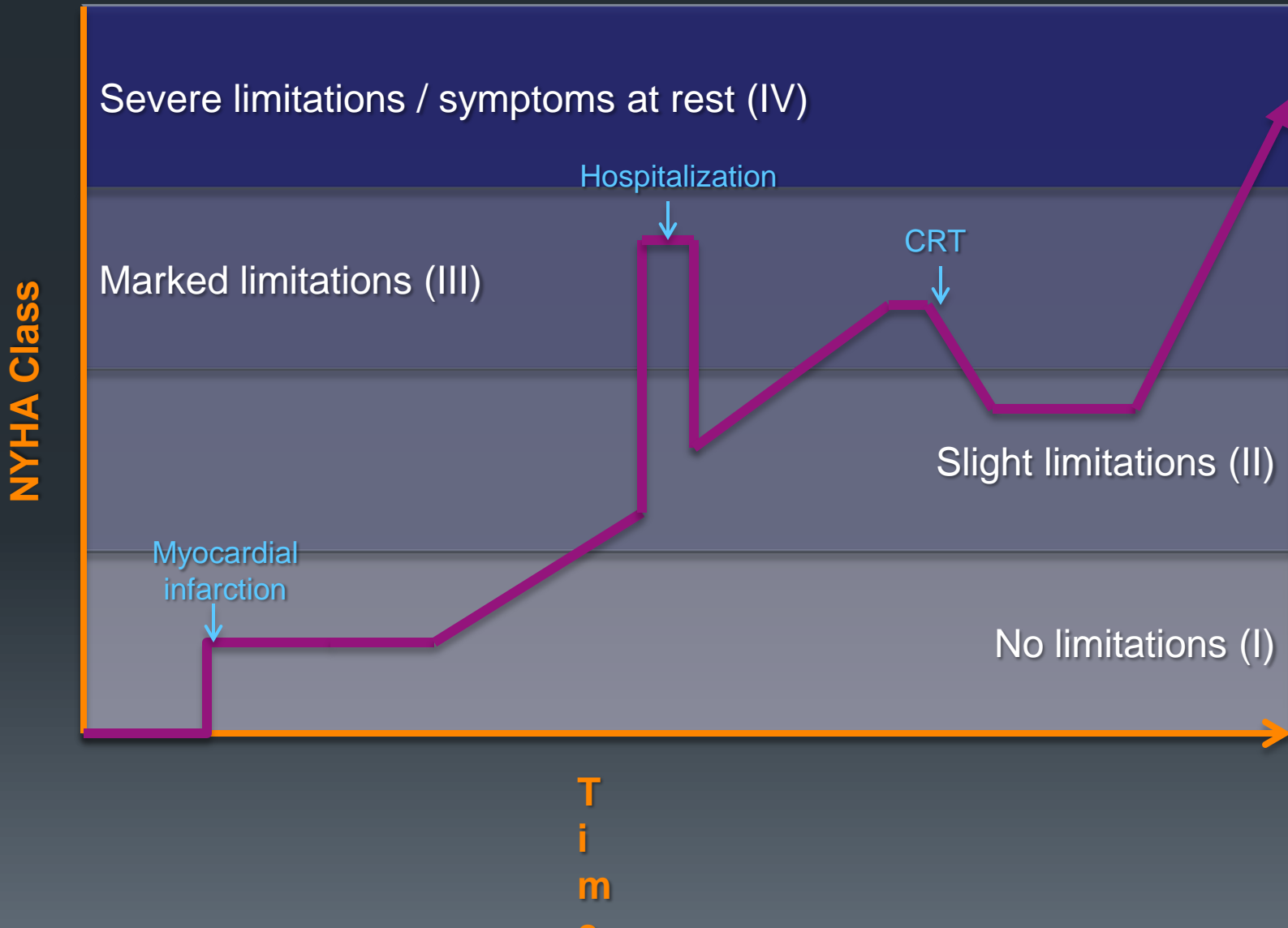
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Advanced Heart Failure and Transplant Program
VA Palo Alto Health Care System

Overview

- Heart failure as a chronic, often progressive disease
- What is advanced heart failure?
- How do I recognize it?
- What are the available therapies?
 - Heart transplantation
 - Mechanical circulatory support
 - Palliative care

A chronic, progressive disease



Heart Failure Stages

	NYHA I	NYHA II-III	NYHA IV
	Internists Primary Care Practitioners		Cardiologists Heart Failure Specialists
	Lifestyle changes Medications		Medications Mechanical Support Surgery & Transplant Palliative Care
Stage A	Stage B	Stage C	Stage D

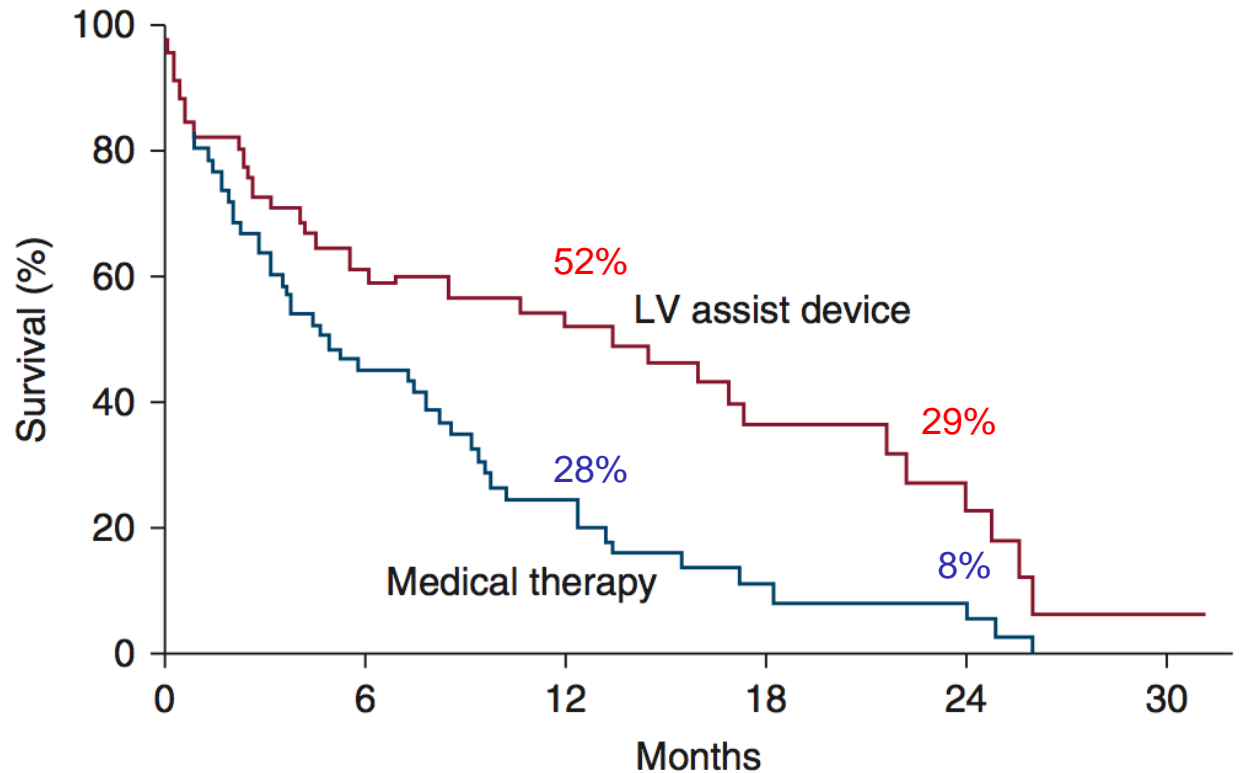
Advanced heart failure: what is it?

- Generally, requires **longitudinal** perspective.
- **NYHA Class III or IV** despite optimally treated medical and device (CRT) therapy.
 - Symptoms limiting daily life
- Typically, **systolic heart failure**
 - LVEF <25%
- **Intolerant of medications** (ACE-I, ARB, beta-blockers)
 - Hypotension
 - Renal dysfunction
- 2 or more HF-related **hospitalizations** within the past year

Prognosis in advanced HF

REMATCH Population:

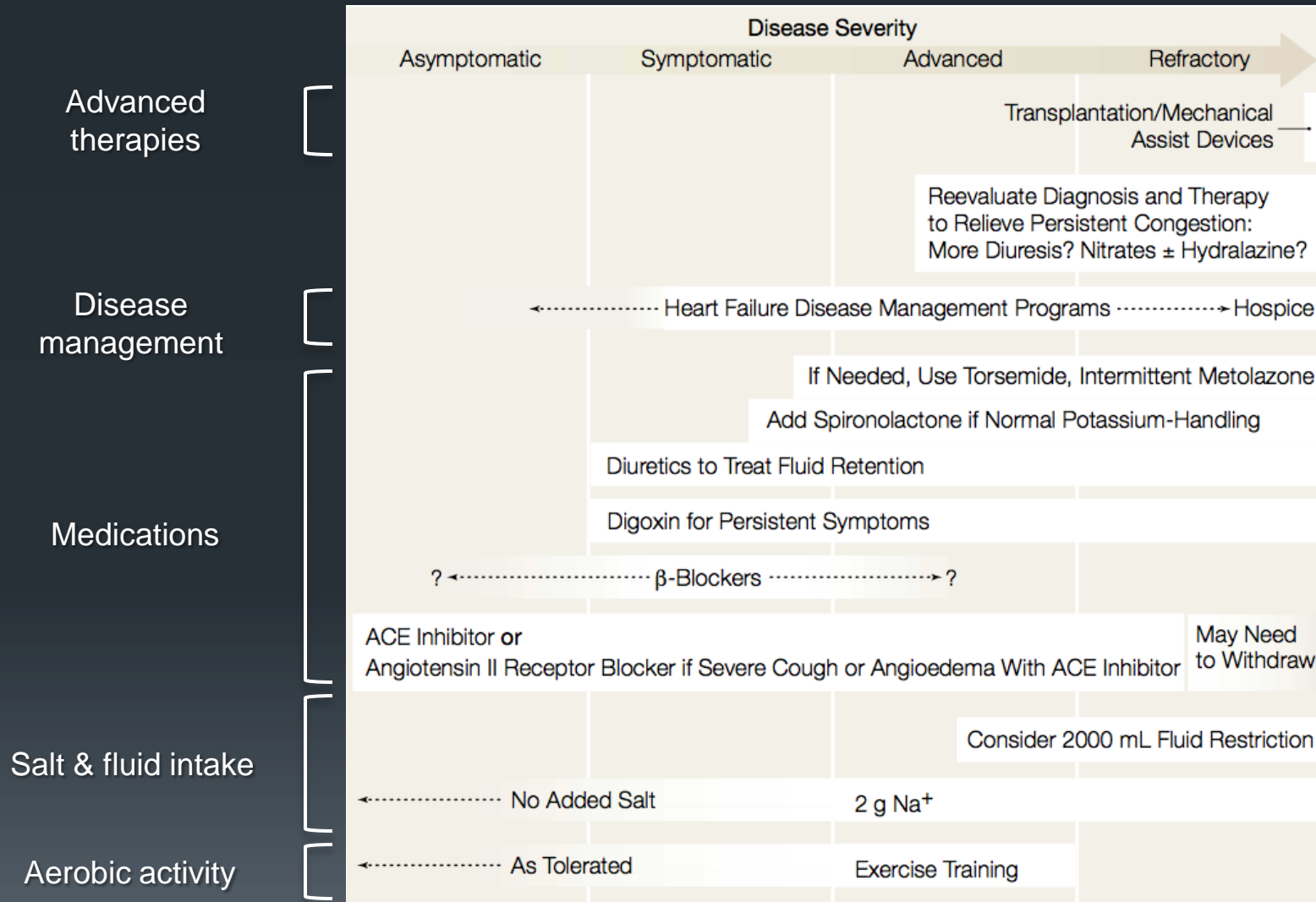
1. NYHA Class IV
 - 60 days
 - Optimal meds
2. NYHA Class III-IV
 - 28 days and
 - Inotropes (14 d)
 - IABP (14 d)
3. LVEF \leq 25%
4. VO₂ \leq 14 cc/kg/min



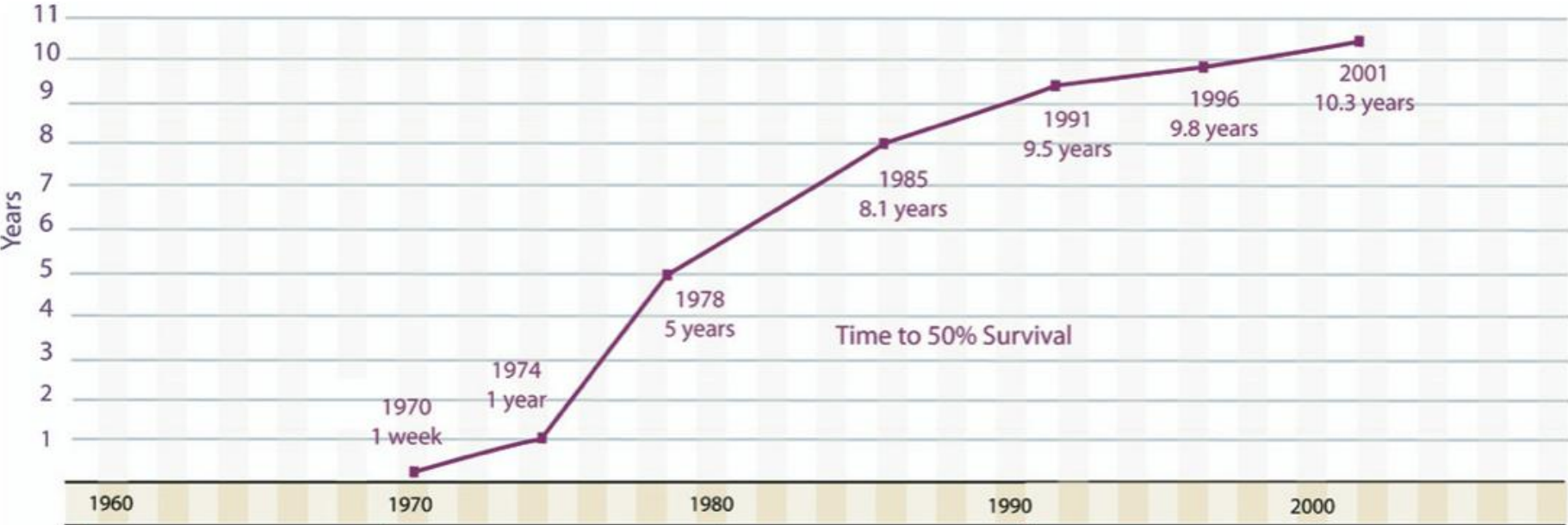
No. at risk

LV assist device	68	38	22	11	5	1
Medical therapy	61	27	11	4	3	0

Therapies for Advanced Heart Failure



Heart Transplantation Timeline



1960. Surgical technique of heart transplantation pioneered by Normand Shumway

1967. Christiaan Barnard performs the first human to human heart transplantation

1969. Denten Cooley uses first total artificial heart as a bridge to transplant

1973. Philip Caves develops technique of endomyocardial biopsy. Margaret Billingham develops a system for reading specimens

1983. Cyclosporine approved by the FDA

1984. First successful use of a ventricular assist device

1991. Sievers develops the bicaval technique for orthotopic heart transplantation

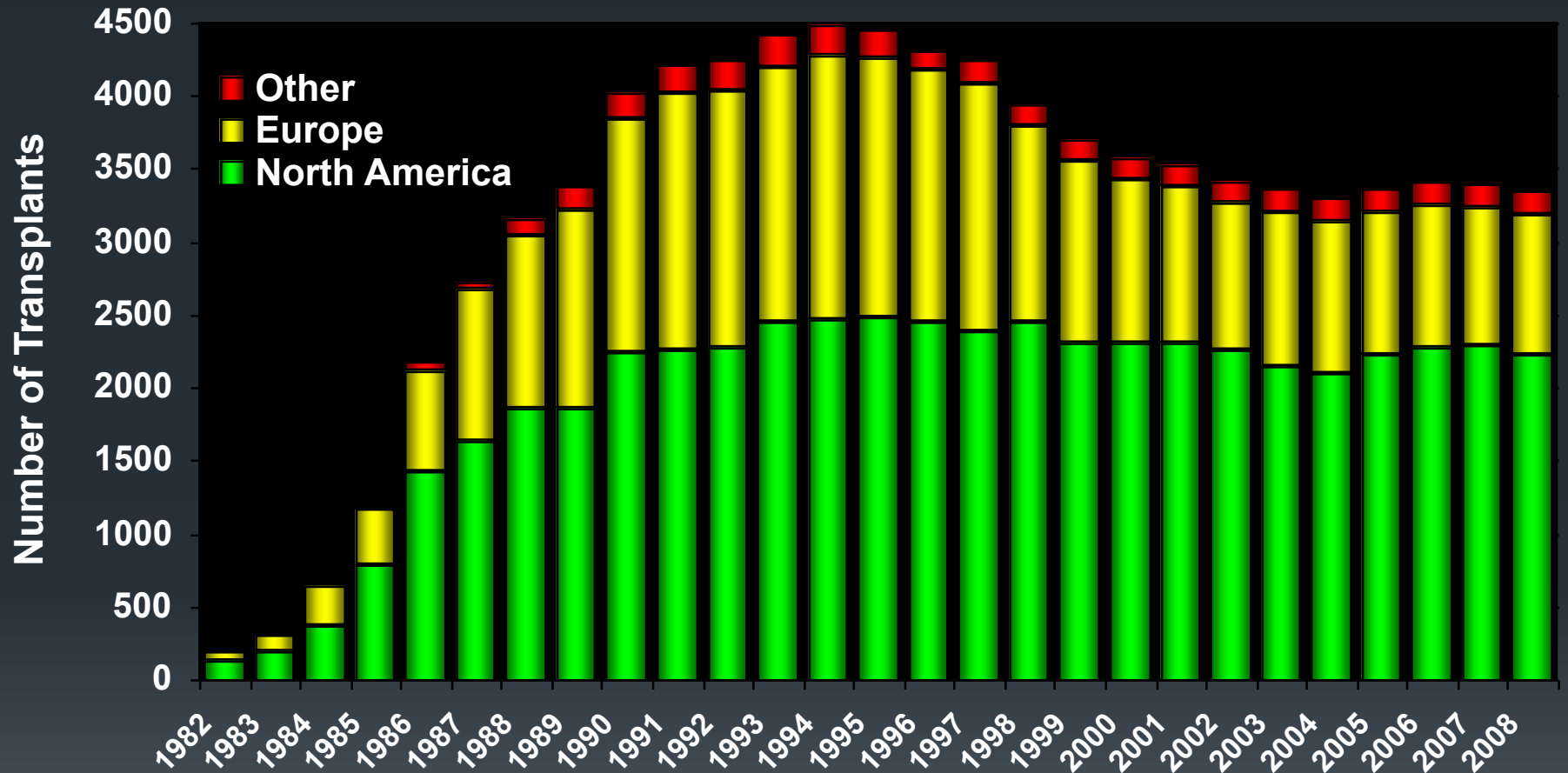
1990's. Introduction of MMF and tacrolimus

Late 1990's. Trials with sirolimus and everolimus. Introduced clinically early 2000 (everolimus not yet FDA approved in the USA)

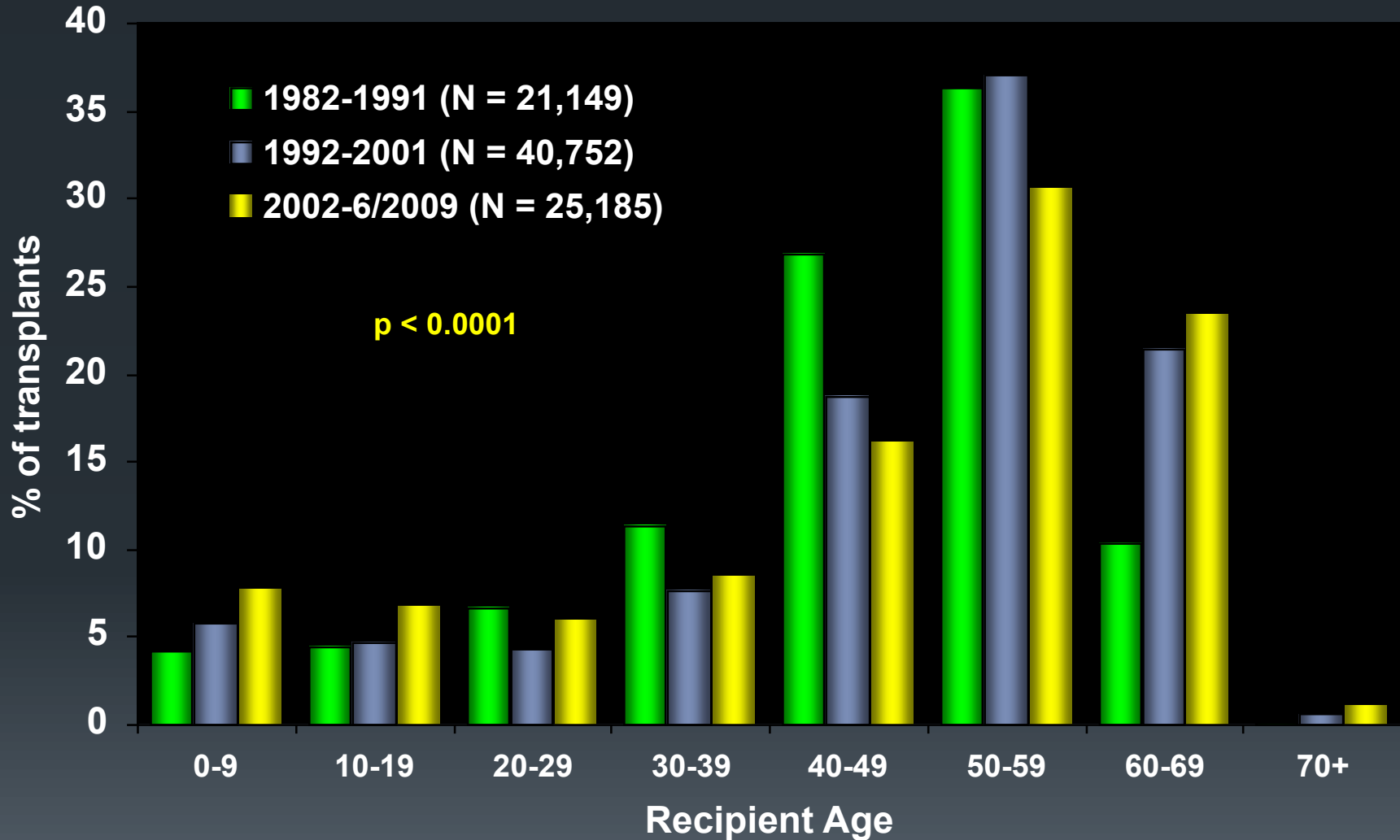
Expected Advances
Expected advances in organ preservation, immune monitoring, and immunosuppression

Hunt et al., JACC 2008

Heart transplant volume



Age of Heart Transplant Recipients



Heart Transplant Recipient Selection

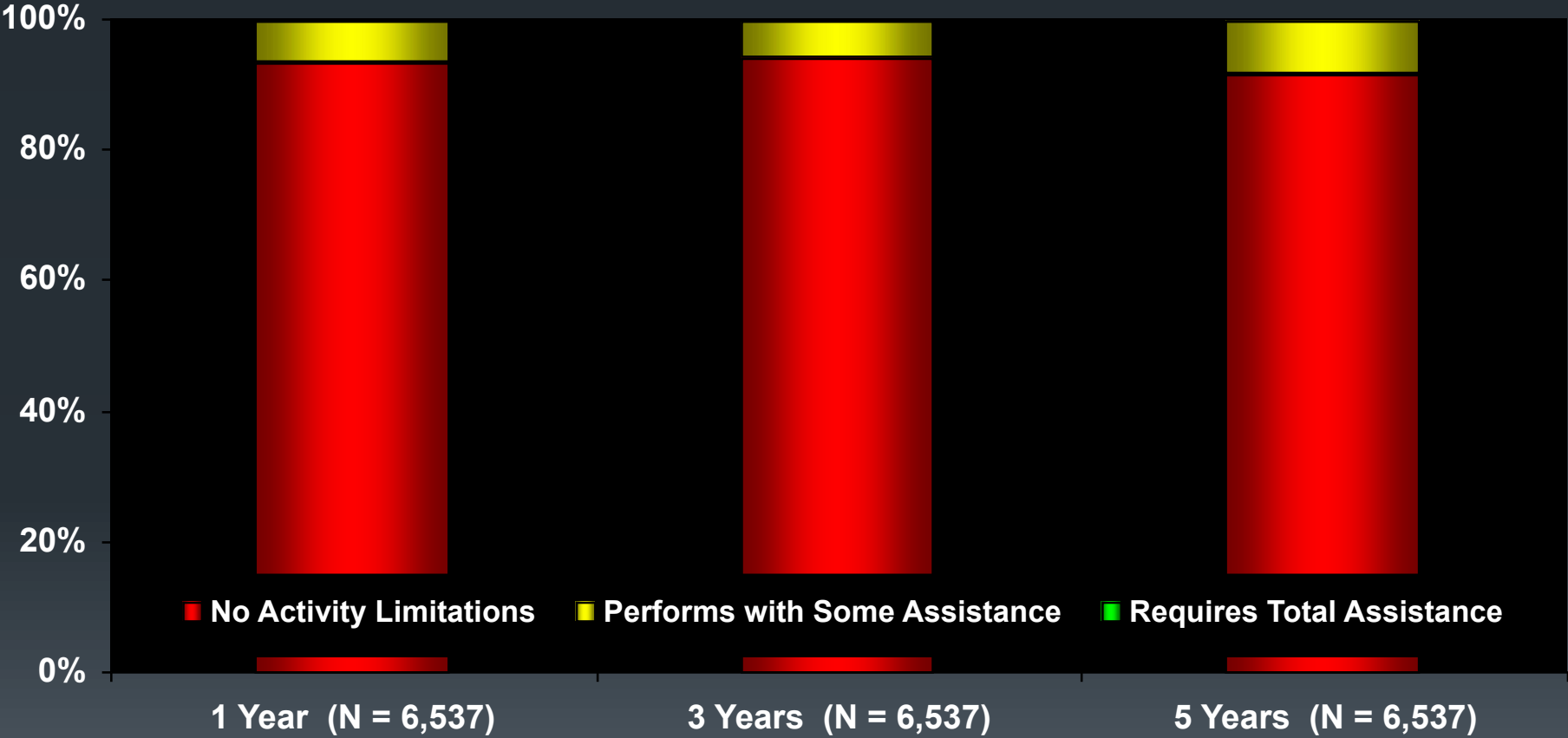
Indications

- Advanced systolic heart failure
 - NYHA Class III or IV
 - VO_2 max ≤ 12 cc/kg/min (on β -blockers) and ≤ 14 cc/kg/min (intolerant β -blockers)
- Incessant VT
- Refractory, severe angina
- Cardiogenic shock
 - When condition not predicted to improve
- Hypertrophic or restrictive CM
- Congenital heart disease
 - Failed Fontan conduit
 - Failing systemic ventricle
- Cardiac tumors
 - Low likelihood of metastasis

Contra-indications (most relative)

- Advanced age (>70)
- Active systemic infection
- Irreversible pulmonary hypertension
- Severe renal*, hepatic*, or pulmonary disease
- Obesity (BMI > 30 or $>140\%$ IBW)
- Severe peripheral vascular disease
- Diabetes mellitus
 - End-organ damage
 - Poor glycemic control (HbA1c >7.5)
- Active or recent malignancy
- Recent pulmonary infarction
- Ongoing substance abuse
- Psychosocial:
 - Poor compliance
 - Inadequate social support

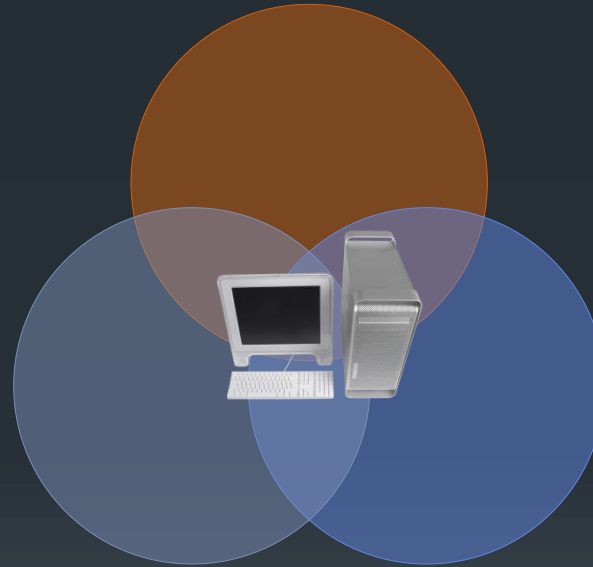
Functional Status of Heart Transplant Recipients



Organ Procurement and Allocation

Transplant Center:

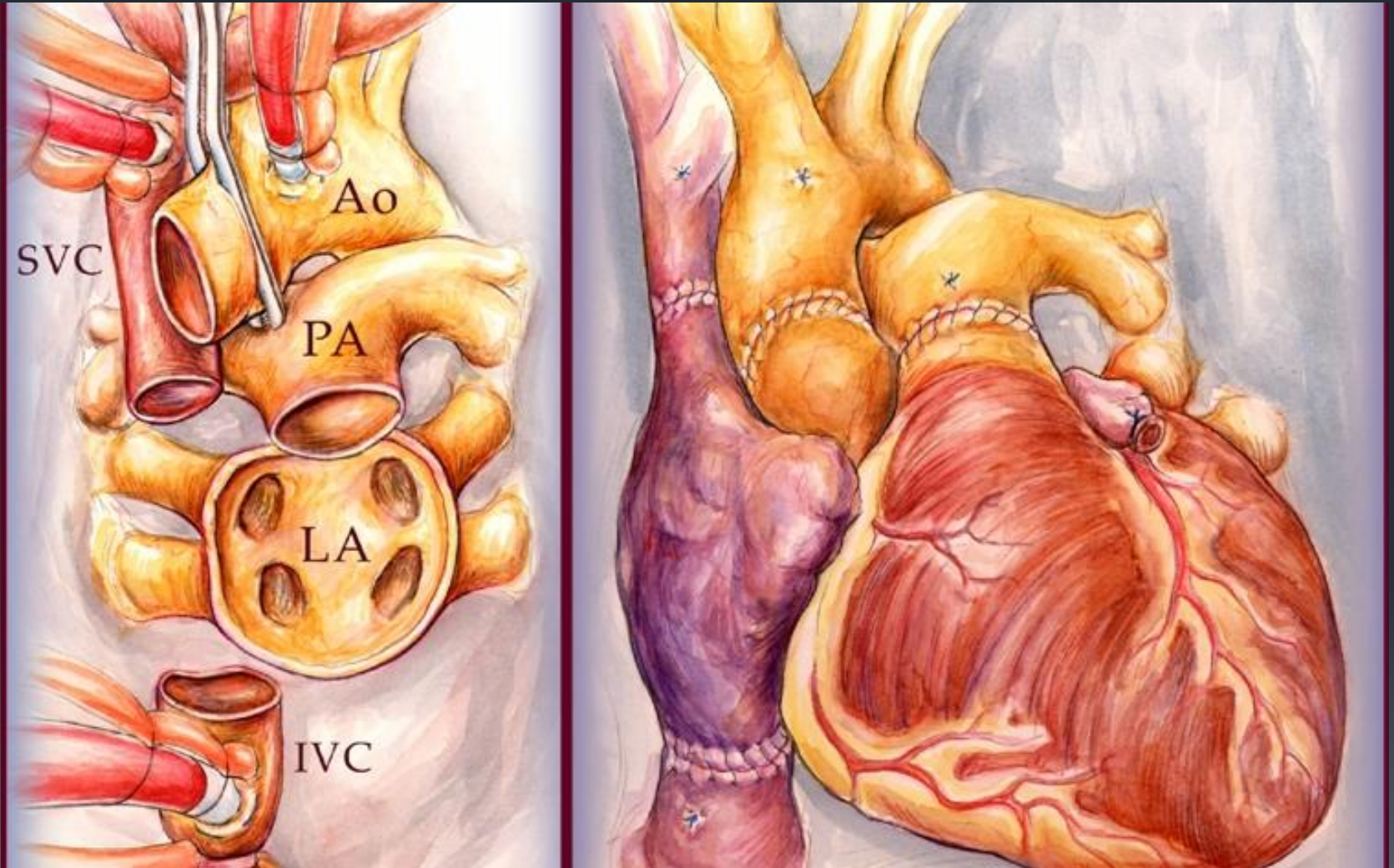
Stanford University Medical Center (SHC, VAPAHCS, Kaiser)



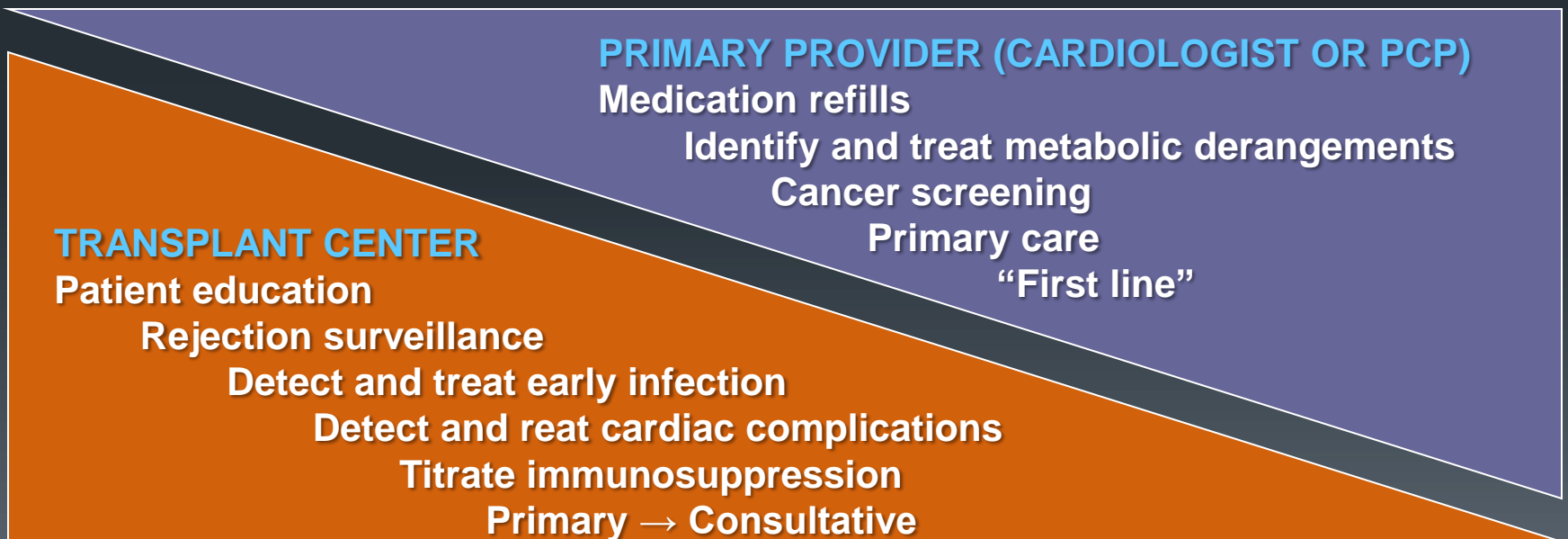
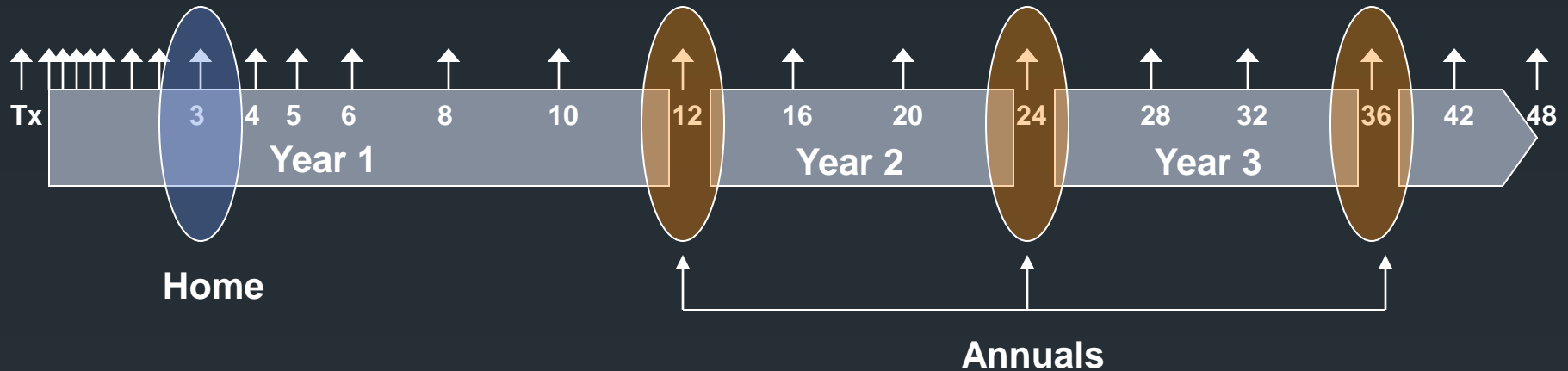
Organ Procurement
and Transplant Network
(OPTN/UNOS)
National policies
11 Geographic Regions
Waiting List

Organ Procurement
Organization (OPO)
Northern Cal: CTDN
Donor selection
Donor management
Organ procurement

Bicaval Surgical Technique



Post-Transplant Follow-Up



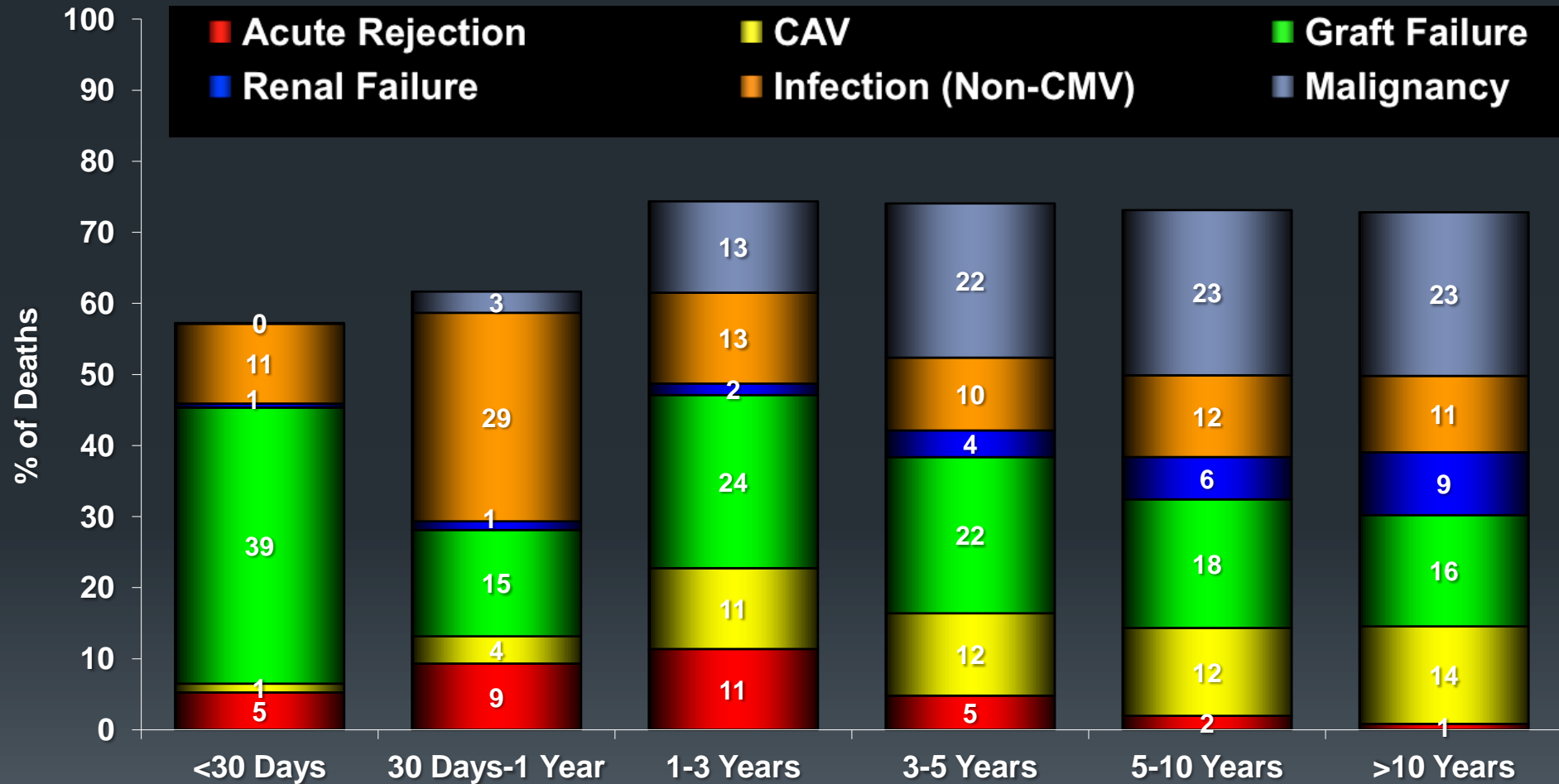
Taking care of a transplant patient

- Immunocompromised due to anti-rejection medications
 - Bacterial, fungal, viral, atypical organisms
 - Private room
 - Usual precautions (wash hands), masks not necessary
- Sinus tachycardia (HR 110-120 may be normal)
- Abnormal ECG
- Subtle symptoms (lethargy, nausea) may be the only signs of rejection or infection
- Patients can have fevers and get sick very fast!
- Beware of medication timing

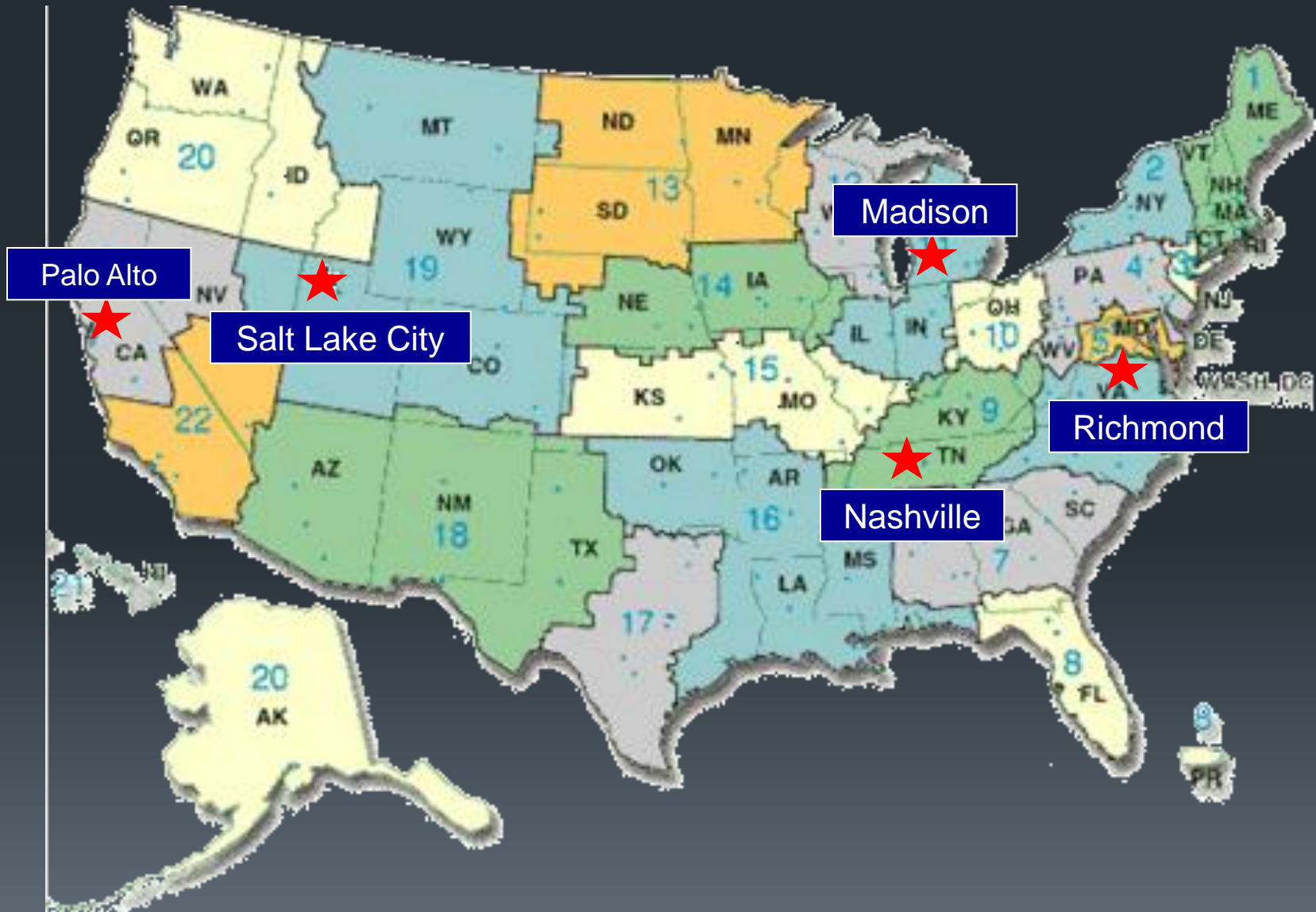
Post transplant complications

Cardiac	Metabolic	Infections	Neoplastic
<p><u>Early</u></p> <ul style="list-style-type: none"> • Acute rejection • Bradycardia • Atrial arrhythmias • Pericardial effusions • Valvular insufficiency <p><u>Late</u></p> <ul style="list-style-type: none"> • Cardiac allograft vasculopathy 	<ul style="list-style-type: none"> • Hypertension (94%) • Renal dysfunction (33%) <ul style="list-style-type: none"> - SCr > 2.5 (9%) - ESRD (3%) • Dyslipidemia (86%) • Diabetes (34%) 	<ul style="list-style-type: none"> • Bacterial • Fungal <ul style="list-style-type: none"> - Aspergillus - Candida - PCP • Viral <ul style="list-style-type: none"> - CMV - HSV - VZV • Atypical <ul style="list-style-type: none"> - Mycobacterium - Nocardia • Parasitic 	<ul style="list-style-type: none"> • Skin cancers (67%) • Lymphomas (10%) • Prostate, lung, breast, cervical, colon (13%)

Causes of Death after Heart Transplantation



VA Heart Transplant Centers



Mechanical circulatory support (MCS)

What is it?

- A ventricular assist device (VAD) is implanted to help boost the heart's pumping ability and to decrease the pressures inside the heart.
- The implant can be:
 - Surgical (sternotomy, thoracotomy)
 - Percutaneous (groin)
- This helps to:
 - Supply adequate blood flow to other organs
 - Promote recovery of the heart (occasionally)

What are the categories of MCS?

- Left ventricular assist device (LVAD)
- Right ventricular assist device (RVAD)
- Biventricular assist device (BiVAD)
- Total artificial heart (TAH)

When is MCS used?

- **Bridge to transplant**
 - Too sick to await a suitable heart donor
 - Cardiogenic shock
 - Malnutrition and cachexia, deconditioning, poor organ function
 - Expected wait for a suitable donor is too long
 - Recipient weight (too big)
 - Blood Type O
 - Antibodies against many potential donors
- **Bridge to recovery**
 - Acute myocarditis
 - Post cardiectomy
- **Bridge to eligibility or decision**
 - Cardiogenic shock with unclear neurologic status
 - Drug use, marginal psychosocial support
- **Destination therapy**
 - Exhausted medical therapy
 - Not a candidate for cardiac transplantation or palliative care

Types of devices

Short Term Devices



Pulsatile Devices

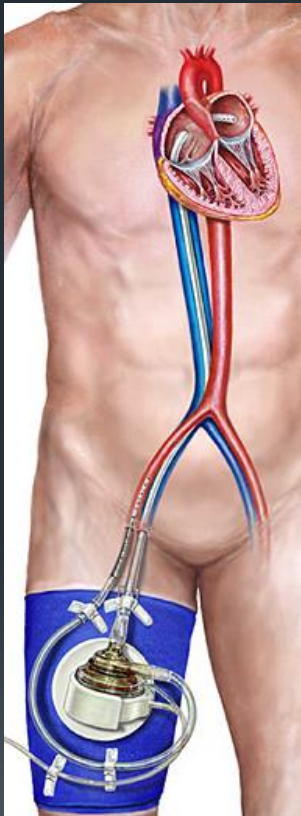
Axial Flow Devices



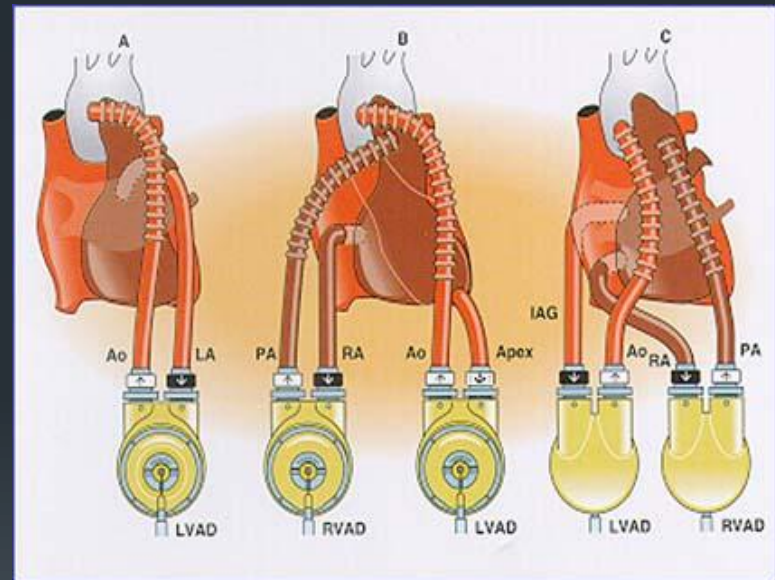
Total Artificial Hearts

Extracorporeal VADs

Tandem Heart

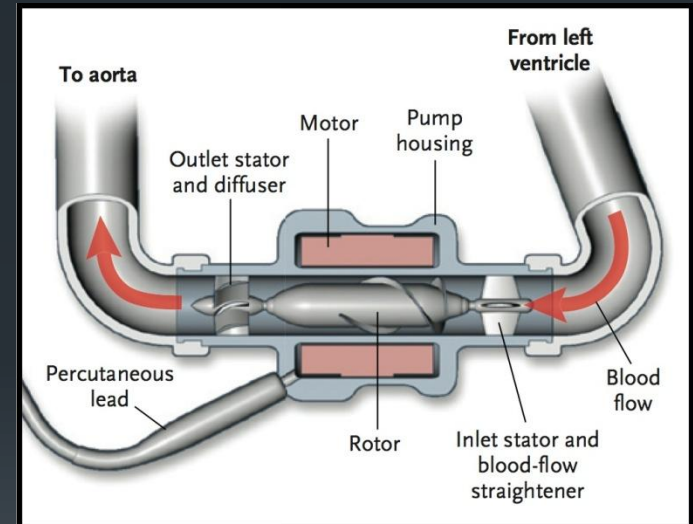
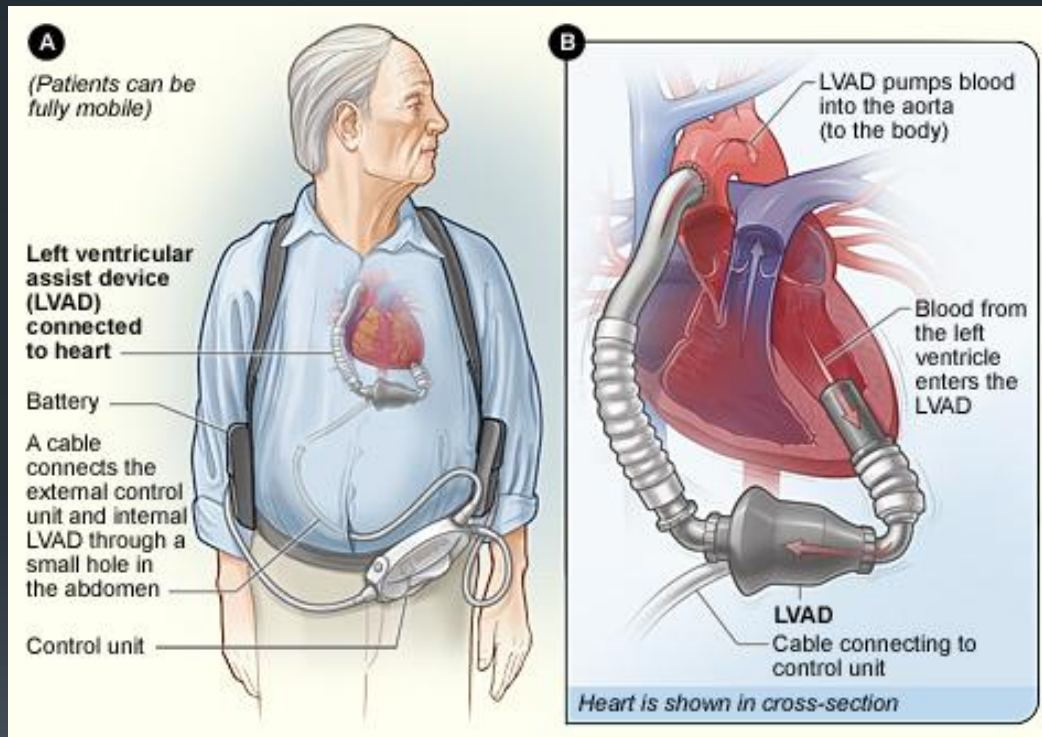


Thoratec® PVAD™



Intracorporeal VADs

HeartMate II (2nd Generation, Continuous Flow Pump)



Criteria for Destination Therapy

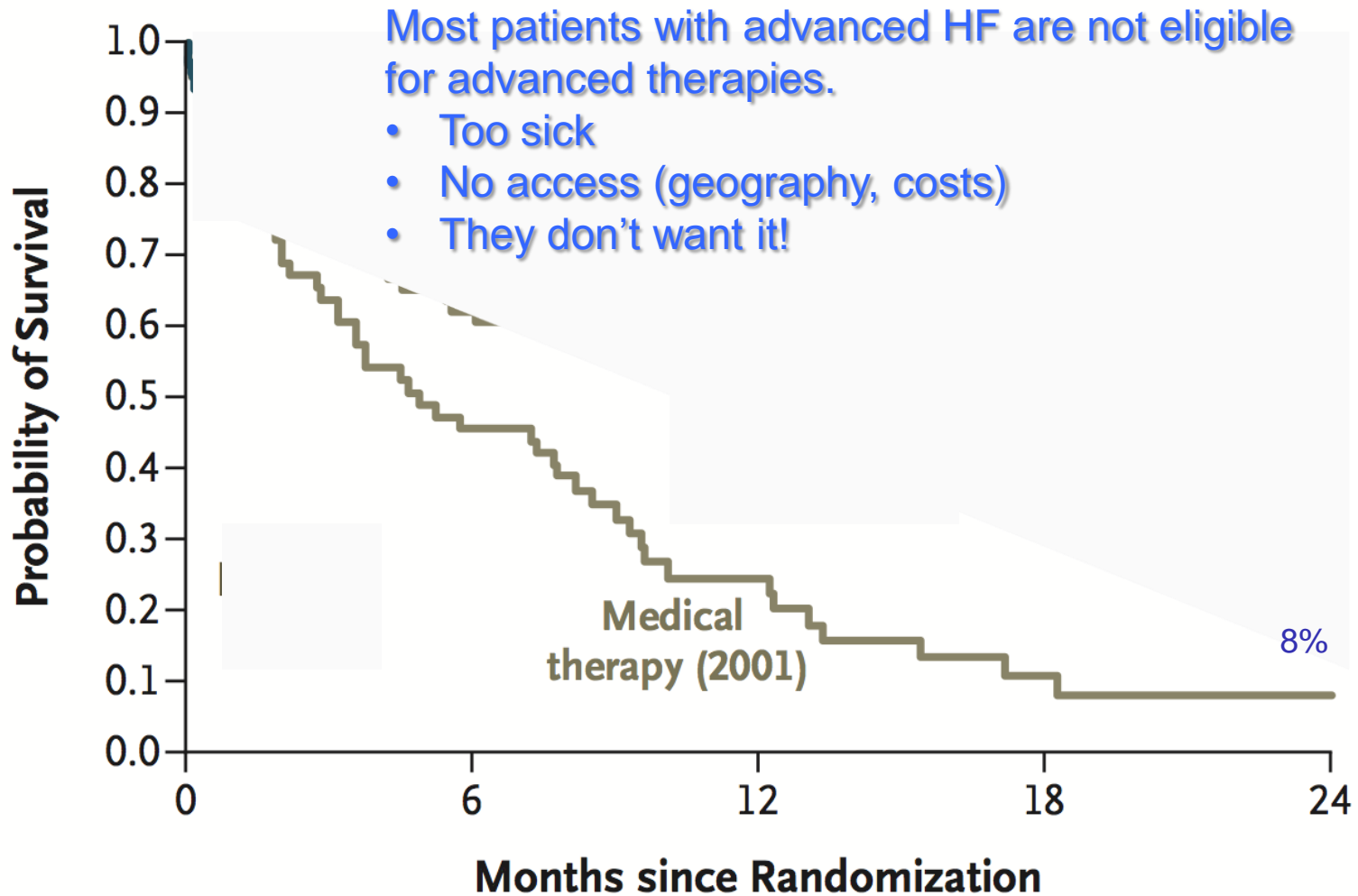
- Not a candidate for cardiac transplantation
- NYHA Class IV despite optimal medical and device therapy for 45 of the past 60 days
- LVEF < 25%
- VO₂ max <14 cc/kg/m² or need for continuous infusion of inotropes
- Absence of any major non-cardiac co-morbidity that may seriously compromise recovery or reduce two-year survival.

Causes of Death after VAD

INTERMACS Registry June 2006 – March 2009

Cause of Death	Total (N=191)	
	No. Deaths	%
Cardiac failure	41	22
Infection	29	15
CNS event	27	14
Multi-organ failure	20	10
Respiratory failure	10	5
All other causes	64	34

Improvement in VAD Survival



Palliative Care



- **Palliative care** (from Latin *palliare*, to cloak) is a specialized area of healthcare that focuses on relieving and preventing the suffering of patients.
- Unlike **hospice care**, **palliative medicine** is appropriate for patients in **all disease stages**, including those undergoing treatment for curable illnesses and those living with chronic diseases, as well as patients who are nearing the end of life.
- Palliative medicine utilizes a **multidisciplinary** approach to patient care, relying on input from physicians, pharmacists, nurses, chaplains, social workers, psychologists, and other allied health professionals in formulating a plan of care to **relieve suffering** in all areas of a patient's life.
- This multidisciplinary approach allows the palliative care team to address **physical, emotional, spiritual, and social** concerns that arise with advanced illness.

Unique aspects of Palliative Care

- Provides relief from physical symptoms: pain, shortness of breath, nausea
- Affirms life and regards dying as a normal process
- Is applicable early in the course of illness, in conjunction with other therapies that are intended to prolong life, such as dialysis, heart failure medications, and home inotropic support
- Integrates the psychological and spiritual aspects of patient care
- Offers a emotional support to help patients
- Offers a support system to help the family cope.

A subtle but important distinction

Palliative Care

- Available at any point in a serious illness.
- Can be combined with life-prolonging treatment (hemodialysis, defibrillator)
- Focus on symptom relief and emotional support
- Can be inpatient or outpatient
- Coordinated by PCP or specialist
- Often available but coverage varies

Hospice

- For patients with terminal diagnosis (<6 months).
- Some life-prolonging treatments are not recommended or supported
- Focus on symptom relief, emotional support, and end-of-life care
- Can be inpatient or outpatient
- Coordinated by PCP
- Typically available, covered by Medicare/Medicaid

Summary

- Advanced heart failure represents the end stages of a chronic, often progressive disease (heart failure).
- The prognosis is poor. 1-2 year survival is worse than most cancers.
- Treatment options include:
 - Lifestyle changes, medications, and disease management but with **different emphasis**
 - Heart transplantation for a limited subset of patients (~2,000/year in the United States).
 - Mechanical circulatory support (VAD)
- Palliative care should not be a separate treatment option but rather should complement existing treatment and should be introduced early in disease course.