Update on Cardiac Transplantation

Defining and Meeting the Challenges of a New Decade

Robert S. D. Higgins, MD, MSHA
Professor and Chief, Cardiac Surgery
The Ohio State University Medical Center
Transplant Signature Program
Quality and Quantity of Life
Transplant Success

GOOD DONOR

GOOD RECIPIENT

GOOD OUTCOME
Historical Context
Louis Washkansky, recipient of the historic transplant, smiles after regaining consciousness.
Heart Transplantation: *Rags to Riches* . . .

**Timeline**

1960 - Lower and Shumway describe surgical technique in dogs.  
Surg Forum 11:18, 1960

1967 - Christian Barnard performs first human to human heart transplant in 54 year old man with severe heart disease
- 24 year old donor injured in car accident; removed from respirator and heart removed after it stops
- Patient succumbs 18 days after surgery 2° to pneumonia

1968 - Shumway performs first heart transplant in U.S.
1968 - 102 transplants performed at 52 centers  
- 30% (30/108) alive at 12 weeks after surgery

1981 - Cyclosporine immunosuppression introduced
Heart Transplantation: “Growing Pains”

Questions raised by early experience:

1. What about the donor?
   - Was she dead or did we facilitate death?
   - What are the criteria of death?

2. Who should perform transplants?
   - Where should they be done?

3. How do we proceed with potentially lifesaving technology? (with bad early results)
Development of Heart Transplantation

Figure 1–8. Norman Shumway, regarded by most investigators as the major contributor to successful heart transplantation, is shown here in 1968, soon after his initial human heart transplant procedure.

Figure 1–5. Principals in the experimental laboratory at Stanford University in 1960. Norman Shumway (left), Richard Lower (right), and Raymond Stotler (right lower) with a long-term surviving dog heart transplant patient.

reality at the University of Capetown in South Africa.
Figure 12–8. The implantation procedure is begun with the left atrial anastomosis.
The US Transplant System
National Organ Transplant Act

- Task Force
- Prohibited buying & selling organs
- Created the modern OPO system
- Scientific Registry
- Organ Procurement & Transplantation Network (OPTN)
United Network for Organ Sharing (UNOS)

- Originated from South Eastern Organ Procurement Foundation (SEOPF) in 1986
- Sole bid for OPTN contract in 1987
- Direct reporting /oversight from HRSA/HHS
- 300+ employees
- As a contractor, UNOS has specific “deliverables” as part of it’s responsibilities
The Problem

Demand

Supply
UNOS-Organ Center
Transplant Program Requirements

- Surgeon (+/- fellowship)
- Physician
- RN Coordinator
- Financial Consultant
- Social Worker/Mental Health
- OPO Affiliation/support
- Histocompatibility Lab
- Operating room anesthesia/nursing
- ICU Critical care/nursing
- Pharmacy
- Blood bank
- Infectious disease
Transplant Signature Program
Teamwork committed to Quality and Quantity of Life – OSUMC 2010
Congestive Heart Failure

Epidemiology

- 4.9 million Americans
- Incidence: 10/1000 in population after 65 years
- 400,000 new cases diagnosed yearly
- 70% of men, 79% of women with CHF have history of hypertension
Myocardial Infarction & Remodeling

Repair is limited to hypertrophy and scar formation due to inability of cardiomyocytes to proliferate.
Heart Failure
Left Ventricular Dysfunction- Preoperative MRI
Congestive Heart Failure

Consensus Treatment Strategy

- Ace Inhibitor
- Vasodilator (nitrates)
- Diuretic
- Beta Blocker
Indications for Heart Transplantation

- End-Stage heart failure - NYHA class III or IV on maximal medical therapy evidenced by:
  - Reduced LVEF
  - Severe diastolic dysfunction
  - Reduced functional capacity (VO2 ≤ 12)

- Inoperable coronary artery disease with intractable angina symptoms refractory to medical therapy

- Malignant ventricular arrhythmias unresponsive to medical or surgical therapy
The Prognostic Value of Maximal Oxygen Consumption

*C p<0.005 for VO2 ≤ 14 vs > 14

Circulation 1991;83:778-786
Contraindications

- Age >70
- Obesity (BMI >35) or severe malnutrition
- Current tobacco, alcohol, or illicit drug abuse
- Active or recent malignancy
- AIDS
- Pulmonary hypertension (fixed)
- Severe end-organ complications from diabetes mellitus
- Major chronic debilitating illness (COPD, neurologic disorders)
- Severe peripheral vascular disease
- Social issues (lack of support)
- Medical non-compliance
In the meantime... waiting for a heart transplant

Left to right:
Mr. J. Everett Logan, Mrs. Launa Logan, Dr. Robert Higgins
US Patients Listed, Transplanted, and Died on Waiting List

- **Heart List**
- **Transplanted**
- **Death**

Year:
- 93
- 94
- 95
- 96
- 97
- 98
- 99
- 00
- 01
- 02
- 03
- 04

Numbers:
- 0
- 500
- 1000
- 1500
- 2000
- 2500
- 3000
- 3500
- 4000
- 4500
FIGURE 18.13  ■ Bicaval anastomotic technique.
Physiology of Transplanted Heart

- Denervated heart
- Atrial dissociation leads to decreased atrial contribution to filling, tricuspid insufficiency
- Exercise response - blunted early catecholamine dependent late
Thoracic Transplantation

- Cyclosporine/FK506
- Azathroprine/Myocophenalate
- Steroids

Induction Therapy
- Antilymphocyte, antithymocyte globulin
- OKT₃
Figure 111-4. The biopsy is inserted by a percutaneous Seldinger technique via the right internal jugular vein, advanced under fluoroscopy, and apposed against the interventricular septum for biopsy.
NUMBER OF HEART TRANSPLANTS REPORTED BY YEAR

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.
Cardiac Transplantation

Complications

- Infection
- Rejection (acute and chronic)
- Cancer
  - solid tumors
  - lymphoma
HEART TRANSPLANTATION


Half-life = 10.0 years
Conditional Half-life = 13.0 years

N=70,702

N at risk at 22 years: 33

J Heart Lung Transplant 2007;26: 769-781
OSUMC Statistics

- Waiting times
  - 4.9 months 1/03-6/08 (national avg 4.6 months)

- Waitlist mortality
  - 20% for 1/03 to 6/08 (national avg 13.9%)

- Survival rates: January 2010 SRTR statistics
  - One year 88% (national avg 88%)
  - Three year 79% (national avg 81%)
Keys to success after Heart Transplantation

**Conclusions**

- Well defined recipient factors determine early and late morbidity and mortality
- Optimize donor hemodynamics as best strategy to avoid donor allograft contribution to mortality
- Aggressive evaluation, monitoring and hormonal resuscitation are best hope to avoid donor problems
- Long term survival mandates close follow-up for rejection, diabetes, renal failure, hypertension and cancer surveillance
OSU Leadership Supports Organ donation and Transplantation