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Learning Objectives

• To understand kidney transplantation as superior to other forms of renal replacement therapy (RRT)
• To understand the advantages of living kidney donation
• To understand kidney transplantation as cost-effective over dialysis
Introduction

• Over 100,000 individuals in the U.S. develop end-stage kidney disease (ESRD) every year

• In the U.S., Diabetes (DM) and Hypertension (HTN) are most common causes of ESRD

• The prevalence of both DM and HTN are increasing leading to an epidemic of ESRD

• Kidney transplantation is a form of RRT that improves survival and quality of life in the ESRD population
Prevalent Counts and Rates of ESRD in the U.S.

[Graph showing the prevalence of ESRD counts and rates from 1980 to 2004 for different causes: Diabetes, Hypertension, Glomerulonephritis, Cystic kidney.]

U.S. Renal Data System, ADR 2005
Risk for All-Cause Death in ESRD by Modality

Event rates

- Hemodialysis
- Peritoneal dialysis

Event-free probability

Rate per 1,000 pt months at risk

Months after day 90

© PD-INEL U.S. Renal Data System, ADR 2005
Transplant Demographics

~70,000 patients on deceased donor waiting list. They are disproportionately African-American, Hispanic and female.

~25,000 added yearly.

~3,500 die on waiting list annually without getting a transplant offer.

~1,000 annually are removed from list b/c they are too sick to transplant.

~9000 patients transplanted from list annually.
Sources of Donors

• Living Donors:
  – Living Related (LRD)
  – Living Unrelated (LURD)

• Deceased Donors:
  – Standard Criteria (SCD)
  – Extended Criteria (ECD)
  – Deceased Cardiac Death (DCD)
Living Donor Selection

• Selection bias towards protecting donor candidate
• Living donors must be altruistic and be healthy
• Living donor contraindications:
  – Diabetes Mellitus (Type 1, Type 2 or gestational*)
  – Hypertension (BP > 140/90)
  – Active malignancies, infections or substance abuse
  – Donor age < 18 or > 60

*Can make exception if gestational DM long ago and candidate is not currently diabetic
Advantages of Living vs. Deceased Donor Transplantation

- Pre-emptive transplantation
- Less rejection
- Better graft function
- Longer graft survival
Deceased Donors
Standard Criteria Donor (SCD)

- Age < 60
- No known kidney or vascular disease
- Brain Death – due to trauma, anoxia, stroke
- Diagnosis:
  - Unresponsive
  - Apneic
  - EEG or blow flow study
Deceased Donors
Extended Criteria Donors (ECD)

• All donors age $\geq 60$ regardless of co-morbidities
• Donors between the ages of 50-59 who have at least 2 of the 3 following criteria:
  – Stroke
  – Hypertension
  – Serum creatinine $>1.5$
• Generally still brain dead donors
Deceased Donors

Deceased Cardiac Death (DCD)

• Cardiac death (on life support), but not brain dead
  – No chance of recovery
  – Family decides to withdrawal life support
  – Physician caring for patient declares them dead
  – Wait 5 minutes and proceed with donation
Deceased Donor Kidney Allocation

- Waiting time
  - From time of acceptance at a transplant center
- Matching
- Panel Reactive Antibodies > 80%
- Pediatric candidate
- Prior living kidney donor
Number of Transplants/Year by Donor Type

- Deceased
- Living, related
- Living distant/unrelated
- Living, unk.
Recipient Selection

• Selection criteria
  – Bias toward offering transplant when possible
  – Standard of care for all causes of ESRD

• Contraindications
  – Severe coronary artery disease not amenable to intervention
  – Severe peripheral vascular occlusive disease
  – Severe pulmonary disease
  – Active malignancies or infections
  – Non-adherence to medical regimen
  – Severe obesity or malnutrition
Advantages of Kidney Transplantation

- Improved patient survival
- Improved quality of life
- Cost effective
Outcomes of Kidney Transplantation

- One year patient survival > 95%
- One year living donor graft survival about 95%
- One year deceased donor graft survival 85-90%
- Transplant half-lives (years)
  - Living: ~20yrs
  - Deceased: ~10yrs
Survival With Different Forms of RRT
Survival After Kidney Transplant

*Adjusted for age, sex, race, ESRD cause, waitlist year, region, and time to waitlist

Days since transplantation (equal time since waitlisting)
Causes of Death After Kidney Transplant

- MI: 30.3%
- Stroke: 11.3%
- Other Cardiac: 17.8%
- Tumors: 11.9%
- Infection: 6.9%
- Other: 21.9%

U.S. Renal Data System
Renal Allograft Survival by Donor Type

% Probability of Survival

Years

Living Donor

Cadaveric Donor

1999 UNOS Annual Report
Annual Cost of ESRD to Medicare
Annual Cost of ESRD
Annual Cost of RRT by Modality

- Transplant event within year
- Graft failure within year
- Dialysis only
- Functioning graft only

PPEY expenditures ($ in 1,000s)

Years: 91, 92, 93, 94, 95, 96, 97, 98, 99, 00, 01, 02, 03, 04

Source Undetermined
Disadvantages of Kidney Transplantation

- Organ shortage leads to long wait times on the deceased donor list
- Morbidity associated with operation
- Negative effects of Immunosuppression
  - Cardiovascular disease
  - Infection
  - Malignancy
  - Bone disease
Pancreas Transplantation

- 10% of kidney transplant recipients
- Indications
  - ESRD from type 1 diabetes mellitus
  - Hypoglycemic unawareness
- Types
  - Simultaneous kidney and pancreas (SPK)
  - Living kidney followed by pancreas (PAK)
  - Pancreas transplant alone (PTA)
Risk and Benefits of Pancreas Transplantation

• Risks
  – Increased risk of surgical complications
  – Increased incidence of infection
  – Potential for pancreas allograft rejection and pancreatitis

• Benefits
  – Protection from hypoglycemia
  – Freedom from insulin, diabetic diet, glucose monitoring
  – Stabilization of retinopathy, neuropathy
  – Reduced future diabetic nephrosclerosis
  – Improved survival?
Results of Pancreas Transplantation

• One-year patient survival > 95%
• One-year pancreas transplant survival
  – SPK 90%
  – PAK 76%
  – PTA 72%
• One-year kidney graft survival with SPK 91%
• Ten-year SPK patient survival 67%
Additional Source Information
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Slide 21: NEJM, 1999
Slide 23: 1999 UNOS Annual Report
Slide 25: Source Undetermined
Slide 26: Source Undetermined