

Brain Death

- California Health and Safety Code 7180
 - "(a) An individual who has sustained either (1) irreversible cessation of circulatory and respiratory functions, or (2) irreversible cessation of all functions of the entire brain, including the brain stem, is dead.

Brain Death

- American Academy of Neurology
 - Unresponsiveness
 - Known cause
 - Irreversible
 - Areflexia
 - No cranial nerve reflexes
 - Apnea

Brain Death

- California Health and Safety Code 7181
 - When an individual is pronounced dead by determining that the individual has sustained an irreversible cessation of all functions of the entire brain, including the brain stem, there shall be independent confirmation by another physician.

Brain Death

- AAN Recommendation for Medical Record Documentation
 - Etiology and irreversibility of condition
 - Absence of brainstem reflexes
 - Absence of motor response to pain
 - Absence of respiration with $PCO_2 \geq 60$ mm Hg
 - Justification for confirmatory test and result of confirmatory test
 - Repeat neurologic examination.

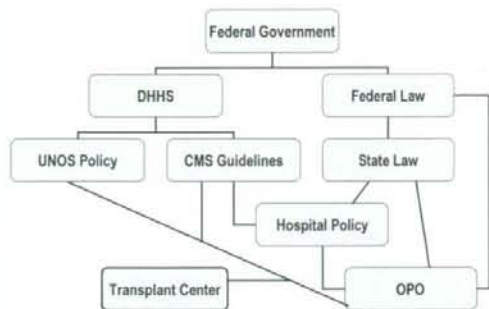
Confirmatory Tests

- Cerebral angiography
- Electroencephalography
- Transcranial Doppler ultrasonography
- Cerebral scintigraphy (technetium Tc 99m hexametzime)

Role of the PTC

- Meet the needs of Regulatory Agencies
- Optimize the gift

Regulatory Agencies (Organ)



Optimize the Gift

- When does it start?
 - Immediately!
- What are the goals?
 - Organ Perfusion
 - Organ Oxygenation

CBIG (another light bulb!)

Catastrophic Brain Injury Guidelines

- brought to us by CMS Collaborative
- improve stability
- improve organ function
- keep things “normal”

CBIG (perfusion)

Maintain SBP > 100 (MAP > 60)

1. Consider invasive hemodynamic monitoring
2. Adequate hydration to maintain euolemia
3. Vasopressor support
 - Neosynephrine (max 20 mcg/kg/min)
 - Dopamine

CBIG (perfusion)

Maintain Urine Output > 0.5ml/kg/hr < 400ml/hr

1. Consider Diabetes Insipidus (DI) if UOP is > 400ml/hr x2 hours and treat with Vasopressin drip or DDAVP
2. If UO falls below 0.5ml/kg/hr, assess fluid status- consider rehydration or BP support

CBIG (oxygenation)

Maintain PO₂ > 100 & pH 7.35-7.45

1. Adequate ventilation
2. Adequate oxygenation
 - 5 - 8 PEEP
 - aggressive respiratory hygiene if not contraindicated by patient's condition (suction and turn every 2 hours)
 - respiratory treatments to prevent bronchospasm

CBIG (other considerations)

Monitor and treat electrolytes maintaining:

- Sodium: 134 – 145 mMol/L
- Potassium: 3.5 – 5.0 mMol/L
- Magnesium: 1.8 – 2.4 mEq/L
- Phosphorus: 2.0 – 4.5 mg/dL
- Ionized Calcium: 1.12 – 1.3 mmol/L

Monitor glucose and treat with insulin drip if needed (keep 80-200) rather than SQ

CBIG (other considerations)

Monitor and treat Hgb / Hct / Coagulation factors (especially with penetrating head injury)

- Maintain Hgb > 8.0 g/dL and Hct > 24%
 - If PT is high, consider transfusion of FFP
 - If Fibrinogen is low, consider FFP or cryoprecipitate
 - If platelets are very low, consider platelet transfusion
- *remember to recheck labs after treatment

Maintain temp 36-37.5 Celsius

CBIG

Provide for best possible outcome

-or-

Preserve the opportunity for
Organ Donation to occur

Organ Donor Management

OneLegacy

- Similar to CBIG
- Treatment of Brain Death (light bulb)
 - Standardize donor management within OneLegacy
 - Maximize the organs recovered per donor

Brain Death

- Catecholamine Storm
- Loss of the Endocrine System

Consequences of Brain Death

Catecholamine Storm

- Due to increased intracranial pressure or brain ischemia
- Sudden large release of Dopamine, Epinephrine (Adrenaline) and Norepinephrine
- Half life of a few minutes
- Causes decreased cardiac function
- Increased lymph flow to lungs
- Precursor to Neurogenic Pulmonary Edema

Consequences of Brain Death

Collapse of the Endocrine System

- Due to the death of the Pituitary Gland
- Causes loss of production of ACTH, TSH and ADH

Hormone Loss in Brain Death

ACTH (adrenocorticotrophic hormone)

- Boosts the synthesis of corticosteroids which regulate metabolism and electrolytes

TSH (Thyroid Stimulating Hormone)

- Stimulates the thyroid to maintain metabolism

ADH (Anti-Diuretic Hormone)

- Regulates free water excretion through the kidneys

Clinical Manifestations of Hormone Loss

- Hypotension
- Hypovolemia
 - Diabetes Insipidus
 - DIC
- Cardiac dysfunction
- Acidosis
- Electrolyte Imbalance

Treatment of Brain Death

Hormone Replacement

- Solumedrol bolus (ACTH)
- Synthroid drip (TSH)
- Vasopressin drip (ADH)

Reduce effects of the catecholamine storm

- Dopamine drip
- Albuterol inhaler
- Narcan

Standard Orders - Nursing

- This patient is brain dead and the legal next of kin has consented for organ/tissue procurement. All orders to be written by OneLegacy Procurement Coordinator.
- Discontinue ALL previous orders.
- 1:1 nursing care.
- Transfer care of the patient to OneLegacy.
- All lab tests and procedures are to be run STAT throughout case.

Standard Orders - Nursing

- A-line and Central Venous Pressure line placement and continuous monitoring.
- Turn patient and suction ETT every 2 hours and prn, using ambu bag and one-time suction kit (preferably red rubber catheter; avoid in-line suction device).
- Maintain HOB at 30 degrees.

Standard Orders - Nursing

- Lubricate eyes every 2 hours with Normal Saline drops.
- Maintain normothermia (96.5-99.5 F) with heating or cooling blanket, rectal/core temps only.
- All vital signs, including core temp and central venous pressure to be recorded every 15 minutes if donor is unstable, otherwise every hour. Record pulmonary artery pressures every hour if pulmonary artery catheter (Swan-Ganz) is in place.

Standard Orders - Nursing

- Maintain central venous pressure 4-6, if possible, while maintaining urine output 1cc/kg/hr to 2cc/kg/hr.
- Intake and Output to be recorded every hour.
- Nasogastric tube to low intermittent suction.

Standard Orders - Nursing

- Notify the procurement coordinator immediately of the following: MAP < 70, > 100, HR < 60, > 120, core temp < 96.5 > 99.5. U/O < 1cc/kg/hr or > 3cc/kg/hr.
- Obtain accurate height and weight (dry weight is preferable).

Standard Orders - Tests

- EKG stat with cardiology consultation for interpretation for donor evaluation.
- Notify echo tech that an echocardiogram will be needed once inotropes are decreased.
- ABG stat on current vent settings and then every 4 hours and prn.
- ABG 30 minutes after any vent change.
- Bedside glucose checks every 2 hours.

Standard Orders - Tests

- Non-digital PCXR stat, taken with patient in full upright position and shot from 72 inches. Wet read by radiologist. Have hard copy of film sent to floor.
- Repeat PCXR every 6 hours, prn and within 3 hours of lung offer.

Standard Orders - Tests

- Draw the following labs immediately and run stat:
 - ABO, Rh, Na, K+, CL, BUN, Creatinine, Glucose, Ca++, Mg++, PO4, CBC with manual differential, PT/PTT/INR, CPK with fractionation, Troponin I, type and hold for 4 units PRBC's, U/A with micro, amylase, lipase, LDH, AST, ALT, Alk Phos, Total Bili, GGT, Total Protein, Albumin, Serum Osmo, ABG, blood cultures x 2, sputum culture with stat Gram stain, urine culture with stat Gram stain, Lactate.

Standard Orders - Tests

- Repeat labs every 6 hours: Na, K+, CL, CO2, BUN, Creatinine, glucose, Ca++, Mg++, PO4, CBC with manual diff, U/A with micro, PT/PTT/INR, LFT's, amylase, lipase, cardiac enzymes, lactate.
- Draw terminal labs no less than 2 hours before OR time: Na, K+, CO2, BUN, Creatinine, glucose, Ca++, Mg++, lipase, amylase, CBC, U/A with micro, lactate.

Standard Orders - Pharmacy

- Standard Hormonal Resuscitation for All Brain Dead Donors
 - Initiate T4 protocol utilizing the below protocol
 - IV Bolus the following in succession:
 - 30 mg/kg Solumedrol (max 2 Gms)
 - 20 units regular insulin
 - 1 amp 50% dextrose (25 grams)
 - 20 mcg T-4, **THEN**
 - → T4 drip 200 mcg in 500cc NS at 25cc/hr (10mcg/hr) & titrate as needed to MAP \geq 60 or max of 75cc/hr.

Standard Orders - Pharmacy

- Vasopressin 1 U bolus **THEN**
- Vasopressin drip 100U in 100cc; start at 0.5U per hour not to exceed 4U per hour; titrate to MAP \geq 60, UO 3cc/kg/hr
- Maintenance intravenous fluid is to be reordered.
- Vasoactive drips are to be reordered as needed.

Standard Orders - Pharmacy

- Reorder current antibiotics if patient has had an ID consult and infection has been identified. Otherwise follow protocol listed below.
 - Zosyn 3.375 Grams every 6 hours IVPB if intubated less than 5 days **OR**
 - Vancomycin 1 Gram daily IVPB if intubated greater than 5 days **OR**
 - Levaquin 500 milligrams daily IVPB if intubated greater than 5 days **OR**
 - Antibiotics as suggested by Pharmacy

Standard Orders - Pharmacy

- Dopamine at renal dose if not already started.
- Albuterol 8 puffs every 4 hours.
- Narcan 8 mg IVP

Critical Thinking

- Assess
- Analyze
- Plan
- Implement
- Evaluate

- Big picture skills
- Seek input

Treat Manifestations of Hormone Loss

- Balance electrolytes
- Administer crystalloids and colloids
- Administer blood product
- Correct coagulopathy
- Normalize blood pressure
- Regulate blood sugar as needed
- Correct metabolic acidosis
- Optimize oxygenation and ventilation

Balance Electrolytes

- 0.45% NS
- Anticipate Potassium replacement
- Replace Calcium
- Replace Magnesium
- Replace Phosphorus
- Excrete/Dilute Sodium

Crystalloids and Colloids

- 0.45% NS
- Albumin 25% (third spacing)
- Albumin 5% (volume expander)
- Avoid D5

Blood Products

- Maintain H & H > 10 & 30
- Transfuse pRBC's prn
- Transfuse FFP prn

Correct Coagulopathy

- Prolonged PT (approximately 18):
 - FFP 1-2 units
- Prolonged PTT (approximately 45):
 - Consider STAT fibrinogen
 - Cryoprecipitate if < 100
- Platelets if < 50,000 - 20,000

Correct Metabolic Acidosis

- Ensure it's not Respiratory
- Sodium Bicarb
- Tham
- Flush! (fluid and Lasix / Bumex)

Normalize Blood Pressure

- Dopamine
- Dobutamine
- Neosynephrine
- Epinephrine
- Levophed

Normalize Blood Pressure

- Morphine (vasodilation)
- Nipride (with normal HR)
- Esmolol or Labetolol (with elevated HR)
- Diurese

Regulate Blood Sugar

- Accuchecks q 2 h
- Regular Insulin IVP
 - Use sparingly
- D50

Oxygenate/Ventilate

- Normal Good ABGs
- Maximize Vt (10 – 15ml/kg)
- PEEP + 5
- FiO2 40% minimum
- Alveolar recruitment
- Prolong inspiratory time

And another thing

Maintain normal body temperature

We Need Your Support!

- Nurse
- Physician
- Pharmacist
- Lab Tech, Pathologist
- Pulmonologist and Respiratory Therapist
- Cardiologist, EKG tech and Echo Tech
- Radiologist, Radiology Tech and Ultrasonographer

We need your support

- Social Workers
- Hospital Administration
- IT Department
 - Electronic allocation of organ requiring high speed internet access

How You Support the Process

All Donors

- Evaluation to include
 - Donor Medical Chart, Physical Examination, Medical/Social Screening and Vital Signs
- Lab testing
 - CBC, electrolytes, serologies, blood type, Blood / urine / sputum cultures
 - CXR
 - EKG

How You Support the Process

Potential Renal Donors

- Urinalysis, Serum BUN and Creatinine
- Possibly, a renal ultrasound

Potential Liver Donors

- Serum Liver Function Test (LFTs)
- Possibly, a liver ultrasound

How You Support the Process

Potential Pancreas Donors

- Serum amylase, lipase and glucose
- Accuchecks every 2 hours

Potential Heart Donors

- 12 lead EKG
- Echocardiogram with a Cardiologist interpretation
- ABGs

How You Support the Process

Potential Lung Donors

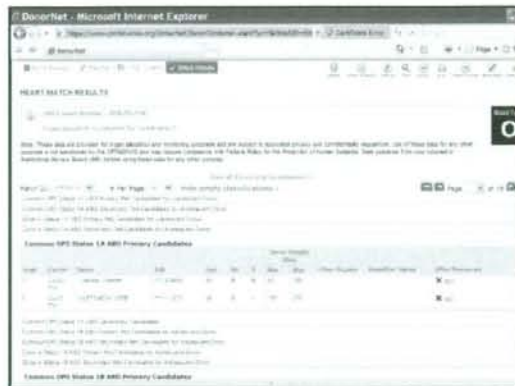
- ABGs on 40% and 100% FiO2 every 4 hours
- Sputum gram stain
- Bronchoscopy
- CXR every 4 hours

Organ Allocation

- UNOS / UNet / DonorNet
 - www.unos.org
- Generate the waiting list
- Electronic notification
- On-line evaluation by transplant centers
- On-line response to the offer
- Organ acceptance determined by phone
- Organ recovery coordinated by phone

Generate the Waiting List

- Status
- Rank
- Transplant Center
- Recipient Name and Age
- ABO
- If cross matching is necessary



Electronic Notification

- Assess lists for:
 - Transplant center grouping
 - Include 2 -3 transplant centers
 - Include up to 10 recipients
 - Transplant centers have 1 hour

On-Line Evaluation

Transplant centers have 1 hour

On-Line Response

- Transplant Center enters
- Decline code
 - Provisional Yes

Organ Acceptance

- All "Provisional Yes"es get a phone call
 - Transplant Center:
 - Additional information
 - More current information
 - Recipient needs
 - Transplant Center needs

Organ Acceptance

- Donor related needs
 - Time constraints
 - OR activity
- "Accept" entered by PTC

Coordinate the Recovery

- Determine convenient time for:
 - OR
 - Transplant Center
 - Off site organ placement coordinator
 - Me
- "Set" OR time

Organ Recovery

- OR will call for us when they are ready
- Recovery order:
 - Heart
 - Lung
 - Liver
 - Kidneys
 - Pancreas
 - Intestine

Organ Recovery

- Repeat bronchoscopy
- Viewing of CXR and echo if possible
- Midline Incision
- Visual function and anatomy of organs
- Dissection of ligatures
- Cannulation of Aorta and IVF
- Cross clamp

Organ Packaging and Transport

- Organ labeling and packaging by OneLegacy
- Paperwork
 - Coroner
 - Op notes
 - Labeling and packaging verification
 - Donor Hospital required information
- Transplant surgeons take their specific organ

Follow up

- Done by Organ Placement Coordinator
- Outcome letters
- HSC debrief
- In-service opportunities

In Conclusion

Our shared mission is to

Optimize the Gift that is Donation

Early intervention and collaboration is key

Kidneys, Pancreas and Small Bowel Organ Placement

Teresita Nuila
Tissue Hospital Service Specialist
(THSS)

Overview

- Organ Procurement and Transplantation Network (OPTN)
- United Network for Organ Sharing (UNOS)
- UNOS Policies
- Donation Process
- Basic Immunology and Histocompatibility
- Extra-Renal Organs
- Renal Organs
- Transplant Centers
- Common Misconceptions

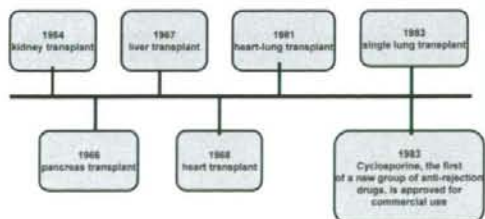
Objectives

Have a basic understanding of the different components of the U.S. organ allocation system

Development of organ transplantation

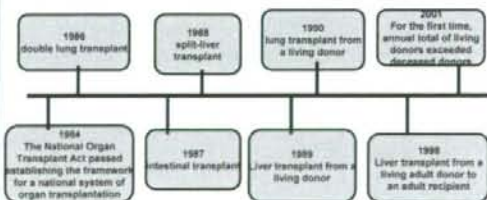
- In 1954, the kidney was the first human organ to be transplanted successfully.
- Until the early 1980s, medical advances in the prevention and treatment of rejection led to more successful transplants and an increase in demand.

U.S. milestones in transplantation



Source: UNOS

U.S. milestones in transplantation (cont.)



Source: UNOS

United Network for Organ Sharing (UNOS) beginning

- UNOS originated in 1977 as an initiative of the South-Eastern Organ Procurement Foundation (SEOPF).
- SEOPF began the Kidney Center in 1982, with staff working around the clock to regionally place available organs. This operation later evolved into the UNOS Organ Center.



National Organ Transplant Act

- In 1984, Congress passed the National Organ Transplant Act which prohibits the sale of human organs.
- Organ Procurement and Transplantation Network (OPTN)



Source: UNOS

Organ Procurement and Transplantation Network (OPTN)

- The National Organ Transplant Act enacted by congress also assigned the task of developing equitable organ distribution policies to the OPTN.

Source: UNOS

UNOS and the OPTN

- UNOS was first awarded the national OPTN contract in 1986 by the U.S. Department of Health and Human Services.
- UNOS is a private, non-profit organization.



UNOS and the OPTN (cont.)

- Under contract with Center for Medicare & Medicaid Services (CMS) of the U.S. Dept. of Health & Human Services
- It continues as the only organization ever to operate the OPTN.

Source: UNOS

UNOS Reasonability's include:

- Facilitating organ matching & placement
- Developing policies and procedures
- Collecting and managing scientific data
- Providing education

UNOS, a model for the world?

- UNOS has served as a model for transplant systems around the world, including the United Kingdom, Germany, Spain, Japan, some South American countries, Mexico and Canada.

Source: UNOS

Organ Allocation Policy

Local

- ❖ OneLegacy's service area
7 Counties

Regional

- ❖ We are in Region 5

National

- ❖ 11 UNOS Regions in the U.S.



Organ Allocation Policy

Local

- ❖ OneLegacy's service area
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National-11 Regions in the U.S.



Source: UNOS

How do you get on the Wait List?

Patient with end-stage organ failure(s) are:

- Evaluated at the transplant center
 - Specific organ testing (i.e. creatinine clearance, echo, chest x-rays, labs, etc.)
 - Psycho/Social evaluation
 - Financial clearance

Source: UNOS

How do you get on the Wait List? (cont.)

- Accepted as a potential recipient
 - Patient selection committee
 - Transplant Coordinator and the MD/Surgeon review patient work-up
 - Patient is cleared for transplant.
 - Added to the UNOS wait list

Source: UNOS

UNOS Organ Allocation Policy

Potential recipients are ranked by these criteria:

Urgency of Need	For heart & liver patients, the very sickest rank at the top of the list.
Time Waiting	Points accrued according to time on Wait List.
Blood Type	ABO must be compatible
Size	Height and weight must be compatible.
Tissue Typing	For kidneys & pancreas

12 Local Transplant Programs

Ronald Reagan UCLA	Cedar Sinai Med Ctr
Loma Linda University	Arrowhead Regional Med Ctr
St. Vincent Medical Ctr	Western Med Ctr
USC University	UCI Med Ctr
St. Josephs Hospital	Harbor UCLA Med Ctr
Children's Hospital Los Angeles	Riverside Community Med Ctr

The Donation Process



Who allocates OL Organs?

Organ Placement Coordinator

- Organ placement coordinator has practical experience in the medical and/or transplantation field.
- Kidney, pancreas and small bowel



The OneLegacy OP department works closely with the following entities:

Procurement Transplant Coordinators
 Family Care Coordinators
 Surgical Recovery Coordinators
 13 Local Transplant Centers
 2 Tissue Typing Labs
 Pathology Labs
 Serology Lab
 Kidney Perfusion Lab (Pump lab)
 United Network for Organ Sharing (UNOS)
 All 58 Organ Procurement Organizations (OPO's) throughout the country.

Local Cases

- What organs/tissue/research received consent?
- What organs are being evaluated for transplant?
- What organs are being ruled out?
- ETA of donor chart?
- Current donor status?
- Pertinent medical/social history?

UNOS policy minimum information for organ offers include:

- Donor name, age, sex, race, height and weight
- ABO type
- Cause of brain death/diagnosis
- History of treatment in hospital
- Vasopressors, hydration and transfusion history
- Current history of abdominal injuries, operations and abdominal trauma
- Sepsis
- Final blood and urine cultures
- Pre- or post-transfusion serologies

UNOS policy minimum information for pancreas offers include:

- Pertinent past medical or social history
- Blood glucose
- Amylase
- Insulin protocol
- Alcohol use (if known)
- Familial history of diabetes



UNOS policy minimum information for kidney offers include:

- Average urine output, and oliguria
- Final urinalysis, BUN and creatinine
- Ultrasound



UNOS policy minimum information for small bowel offers include:

- Laboratory tests within the past 12 hours to include:
 - Total Bilirubin
 - ALT
 - INR (PT if INR not available)
 - Alkaline phosphatase
 - GGT
 - WBC
 - HH
 - Creatinine
 - Arterial blood gas



Status 1 Livers & SB Placement

- Once Status 1 liver calls are made, OPC will make calls for Small Bowel/liver combination off of the small bowel list

Serology

- Donor blood is drawn and sent to lab
- Testing includes:
 - HBsAg, HBCAb, and Anti-HCV
 - VDRL or RPR
 - Anti-HTLV I/II
 - Anti-CMV
 - EBV
- If donor is Hep. C + or Hep. B +, lists must be re-run.



HLA (Tissue Typing)

HLA (Human Leukocyte Antigens)/Tissue Typing

- Important in matching donor and recipient
- Antigens are inherited from parents
- Determine compatibility



Matching Donors and Recipients

How Donors are identified:

- Profile is entered into UNOS/UNet computer system
- Patients on waiting list are ranked
- Computer generates list
- Organ is offered in order of rank

Basic Immunology & Histocompatibility

HLA Antigen Matching

Donor	A2	A24	B8	B44	DR1	DR2
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Recipient	A2	A24	B55	B51	DR7	DR10
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HLA ANTIGEN MATCHING RESULTS

HLA ANTIGEN MATCHING RESULTS

HLA: These data were generated by a computer algorithm and should not be used for clinical decision-making. The results are for informational purposes only. The results are not intended to be used for clinical decision-making. The results are for informational purposes only. The results are not intended to be used for clinical decision-making.

HLA ANTIGEN MATCHING RESULTS

HLA	HLA	HLA	HLA	HLA	HLA	HLA	HLA	HLA	HLA
A	A2	A24	B8	B44	DR1	DR2			
B	B8	B44	DR1	DR2					
C	C6	C6	C6	C6	C6	C6	C6	C6	C6
D	DQ2	DQ2	DQ2	DQ2	DQ2	DQ2	DQ2	DQ2	DQ2
E	E1	E1	E1	E1	E1	E1	E1	E1	E1
F	F1	F1	F1	F1	F1	F1	F1	F1	F1

Types of Kidney Offers

6 Antigen Match/Perfect Match

Donor	A2	A24	B8	B44	DR1	DR2
Recipient	A2	A24	B8	B44	DR1	DR2

Types of Kidney Offers

- Kidney/Extra-Renal
- Directed Donations



Cross-Matching

- Test for patient's anti-bodies against donor antigens
- Cross-matching will take approx. 6 hours



Directed Donation

- OPC is notified of any directed donations of kidney, pancreas and/or small bowel
- **Directed Organ Donation Request Form**
 - ✓ Name of potential recipient & phone number
 - ✓ Social Security Number
 - ✓ Transplant Center where listed
 - ✓ ABO (blood type) of potential recipient, if known
 - ✓ Type of Organ

Imports and Exports

Import Offers

- An offer of an organ(s) being shared from one OPO to another OPO

Export Offers

- The offer of an organ(s) from OneLegacy to an OPO i.e. mandatory shares, six antigen matches.

Operating Room

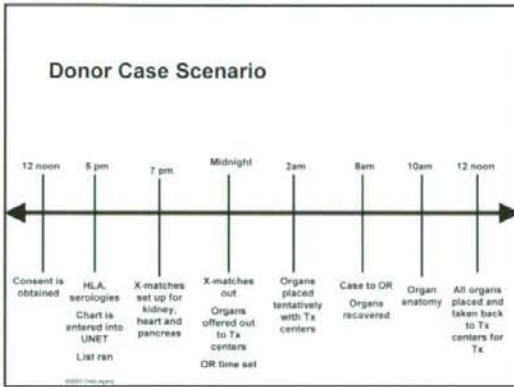
- Recovery blood pressure and urine output information
- Flush and storage solution
- Wedge of spleen
- Anatomical description

Operating Room

- OPC is notified of OR time
- Surgical Recovery Coordinator
- OPC is called with vital organ information
- OR paperwork completed and faxed to OPC



- ### Reasons the top Patient may not receive an organ
- Recipient unavailable
 - High anti-body levels
 - Marginal donor
 - Donor/recipient mis-match
 - Patient refusal
 - Illness



- ### How Do We Maximize Organ viability & graft survival?
- Early referral
 - "Timely" brain death declaration
 - Donor management
 - Organ preservation/packaging
 - Minimize cold ischemic time

Vital Organs & Diseases

Pancreas	Kidneys	Small Int.
Diabetes Mellitus (Type I & II)	Glomerular Diseases	Short Gut Syndrome
Pancreatitis	Diabetes	Functional Bowel Problem
Pancreatic Cancer	Polycystic Kidneys	
Bile Duct Cancer	Hypertensive Nephrosclerosis	
	Renal Vascular Diseases	
	Congenital and Metabolic Disorders	
	Tubular and Interstitial Diseases	

