ORGAN DONATION:
Donation after Neurologic Death
Donation after Cardiac Death

Jennifer Frontera, MD
Neurocritical Care
15 yo M involved in a MVA presents with extensive head injury. His neurological exam is notable for near brain death with the exception of corneals. His parents want to withdraw care but have always been supporters of organ donation and mention this to you.
Question

- Do you:
  1. Withdraw care
  2. Wait for him to become brain dead
  3. Alert your OPO that you have a potential DCD case
  4. Continue with aggressive care
Organ Donation after Cardiac Death
Robert Steinbrook, M.D.

Although the numbers of organ donors and transplantations in the United States have more than doubled over the past 20 years (see line graph), the demand for organs continues to dwarf widely accepted, organs for transplantation have been removed primarily from hospitalized patients who have been pronounced dead on the basis of neurologic criteria, when they are on ventilators...
April 17, 2007

Dear Hospital Administrator:

In an effort to address the shortage of organs available for transplant, both the federal government and the Institute of Medicine have recommended the increased use of DCD. The United Network for Organ Sharing (UNOS) has endorsed the development of DCD policies at all transplant centers, and the Joint Commission on the Accreditation of Healthcare Organizations required all hospitals to have a DCD policy in place as of January 1, 2007.

- Decisions to withdraw and withhold life-sustaining treatment should be made independently from any consideration regarding organ and tissue donation;
- Policies should explicitly differentiate the process of withdrawing and withholding life sustaining treatments, the declaration of death by cardiopulmonary criteria, and the retrieval of organs;
- Health professionals with ethical objections to the practice of DCD should be allowed to decline to participate, and;
- The provision of compassionate end of life care for the patient, and appropriate support for the family, should be a critical aspect of the DCD protocol.
As of 6/16/08
99,049
Candidates
On waiting list

From 1/07-12/07
14,395 donors
And 28,534
transplants

18 patients
Die each day
Awaiting transplant

All the rest of us
UNOS

UNOS.org
Types of Donors

• Donation after Neurologic Death (DND)
• Extended Criteria Donor (ECD)
  – Age >60
  – Age 50-59 PLUS 2 of 3: stroke as cause of death, HTN, Cr>1.5
• Donation after Cardiac Death (DCD)
  – Patients with catastrophic brain injury with intent to withdraw life support are potential organ donors
  – Expected death within 60 min. of withdrawal of life support
• Tissue Donation (cornea, skin, bone, musculoskeletal)
Data are from the Organ Procurement and Transplantation Network.

Organ donors who meet the standard criteria for donation after brain death are usually 59 years of age or younger. The expanded criteria for donation after brain death involve the use of organs from persons more than 60 years old and from persons 50 to 59 years old who have two or three of the following conditions: cerebrovascular accident as cause of death, a serum creatinine concentration of more than 1.5 mg per deciliter (133 μmol per liter), and a history of hypertension. Data are from the Organ Procurement and Transplantation Network.
Contraindications to Donation

- MSOF due to sepsis
- History of cancer EXCEPT:
  - Skin cancer other than melanoma
  - certain primary brain tumors
  - remote prostate cancer
- Infections:
  - Viruses: HIV, HTLV I/II, rabies, reactive HbSAg, measles, rabies, west nile, SARS, adenovirus, enterovirus and parvovirus, active: HSV, VZV, EBV
  - Viral encephalitis/meningitis
  - Fungal: active cyptococcus, aspergillus, histoplasma, coccidoides, candidemia, invasive yeast infection
  - Bacterial: TB, gangrenous bowel, perf’d bowel, intraabdominal sepsis
  - Parasites: trypanosoma, leishmania, strongyloides, malaria
  - Prion disease
- Hep B or C donors can transplant into those with same virus or those in dire need of transplant
- CMV + can be transplanted, better success with prophylaxis

Wood NEJM 2004
Donation after Neurological Death
Definition of Brain Death

• Brain death = legal death
• Irreversible loss of brain and brainstem function
• No universal policy to declare brain death - varies hospital to hospital
• NYS Dept of Health guidelines for age > 1 year
• Top diagnoses leading to brain death
  – SAH
  – TBI
  – Others: ICH, HIE, stroke
Diagnosing Brain Death

- Primarily clinical diagnosis
- 2 exams 6 hours apart for adults
- Includes testing brainstem reflexes and a single apnea test
- If cannot complete apnea test or questionable exam findings, a confirmatory test must be performed
Clinical Criteria Necessary before diagnosing Brain Death

1. Diagnosis compatible with brain death exam
2. Must exclude confounding medical conditions:
   - no severe acid-base abnormality,
   - electrolyte or endocrine disturbance
3. No drug intoxication, poisoning or neuromuscular blockade
   - beware with patients on propofol- can accumulate
   - check Utox if on barbituates/versed/fentanyl
   - Reverse neuromuscular blockade with neostigmine/glycopyrollate, check train of four
   - if known drug cannot be quantified pt should be observed for 4x half life of drug OR confirmatory test
4. Pt must not be hypothermic or hypotensive:
   Core temp $\geq 32^\circ$C and SBP $\geq 90$ mmHg if $\geq 18$ yo
Who can perform brain death exam?

Trainee must be PGY 3 or higher
2 exams 6 hours apart, no brainstem reflexes, no response to pain
Exam findings compatible with brain death

- Spinal reflexes seen in 33-75% of patients
- Triple flexion
- Reflexes including Babinski
- Undulating Toe (flexion/extension)
- Semi-rhythmic facial movement (denervated 7th)
- Finger flexor movement
- Tonic neck flexion (passive neck movement - stereotyped trunk or extremity movement, fencer posturing)
- Lazarus
- Opisthotonus
- Sweating, flushing, tachycardia
- Blood pressure swings
- Respiratory like movements without significant TV
Apnea Test

- Prerequisites:
  - Core temp $\geq 36.5^\circ$C
  - Options:
    - euvolemma,
    - PCO2$>40$ mmHg,
    - PO2$>200$ mgHg
- Complications in up to 26% of pts
  - more frequent when inadequate preoxygenation, acid/base/electrolyte abnormalities, preexisting arrhythmia
- CO2 rise occurs at about 3 mmHg per minute
- If PCO2$>60$ mmHg or 20 mmHg increase over baseline and
- NO respiratory movement= supports brain death
Confirmatory testing

• Often necessary when:
  – Severe facial or C-spine trauma
  – Surgical pupils or preexisting pupillary abnormality
  – Sleep apnea or COPD with chronic CO2 retention
  – Toxic levels of
    • sedatives,
    • aminoglycosides,
    • tricyclic antidepressants
    • Anticholinergics
    • Chemo
    • Neuromuscular blockade
Confirmatory tests

Bilateral insonation ant and posterior
Sensitivity 91-99%, Specificity 100%
10% of patients have no temporal windows

Anterior and posterior injection
Confirmatory tests

- **EEG Criteria:**
  - >2 microV sensitivity
  - Between 1-30 Hz
  - 30 minutes of recording
  - Minimum of 8 electrodes, distance 10 cm apart
  - Impedence between 100-10,000 Ω

- **Technetium SPECT-Tc99**

- **Absent B N20-P22**
  - Less useful with neuropathy or primary brain stem pathology

Wijdicks NEJM 2001
Notification of next of kin

- Physician is responsible to notify next of kin
- Consent not needed to perform or declare brain death
- However, reasonable accommodations should be made for religious or moral family beliefs
- Ethics and palliative care can offer guidance
- Life support should be continued for a reasonable amount of time based on family wishes
Approaching family for organ donation

• Notify NYODN if:
  – impending brain death is suspected
  – If withdrawal of care is planned
  – after all deaths for potential tissue donation

• NYODN, rather than the physicians caring for patient, should reach out to the family

• NYODN typically reaches out after 2\textsuperscript{nd} brain death exam and apnea test confirm brain death
Care for the potential organ donor

- Progression from brain death to somatic death results in loss of 10-20% of potential donors
- Intensive monitoring and care needed to preserve organs
- Aggressive management with bronchoscopy, hormonal therapy and hemodynamic monitoring and management improve organ procurement rate

(Kutsogiannis Can J Anesthe 2006)
A 27 yo W is brought to the ED after being found obtunded. She was observed to be walking on a street and suddenly collapsed. A severe SAH was diagnosed by CT. She is admitted to the ICU. Upon examination, you find that she has no brainstem reflexes; you suspect that she meets brain death criteria. You confirm this later with an apnea test.
The patient’s family is aware of the gravity of the prognosis and is in transit to your hospital. You are called to the bedside because the patient is markedly hypotensive. Physical exam reveals cool extremeties and the SBP is 70 mmHg
Question:

Which one of the following should you do next?

1. Pronounce the patient dead and discontinue mechanical ventilation
2. Write an order for no escalation of current therapy and withhold resuscitative efforts when cardiac arrest ensues
3. Call for a consult from a physician from the neurosciences in order to corroborate your clinical impression of brain death.
4. Consider organ donation and insert a PAC, titrating the patient’s cardiovascular support to indices of cardiac filling pressure, CI and MAP while awaiting the family’s arrival.
Is it ethical to start organ preservation measures when a family has not consented for organ donation?

- Preserving the option to donate
- Hormonal therapy is the most effective way to maintain blood pressure and treat DI in the face of brain death
Effects of brain death

• Medullary level of brain death produces sympathetic surge
  – elevated MAP to maintain CPP (in face of elevated ICP)
• cardiac stunning, myocyte necrosis
• Spinal cord ischemia coincides with herniation resulting in deactivation of sympathetic nervous system
Change in pituitary Function with brain death

Hypotension
Diabetes Insipitus
Cardiac Stunning
Hormonal therapy

- Thyroxin, Vasopressin, Solumedrol and Insulin
- Reduces Cardiovascular lability
- Reduces EKG abnormalities
- Reduces acid-base disturbances
- Improves transplant rates

(Novitzky Transplantation 1987, Novitsky Transplantation 1988)
Evidence for hormonal therapy

• Prospective study of 19 hemodynamically unstable brain dead patients
• All were refractory to volume resusitation, inotropes and pressors
• Received levothyroxine (T4) drip 20 mcg bolus and 10 mcg/h with solumedrol, insulin and D50
• Significant reduction in vasopressor requirement
• 53% had complete discontinuation of other pressors

Salim Archives Surgery 2001
Evidence for hormonal therapy

- Retrospective study 10,292 brain dead donors
- HR of UNOS pathway: T3 4 mcg bolus and 3 mcg/h, insulin 1 u/h to BG 120-180, Pit 1 u bolus and 0.5 u/h
- Univariate analysis:
  - Those with HR yielded 22.5% more organs, \( P < 0.001 \)
- Multivariate analysis with significant increase in donation of kidney, heart, liver, lung and pancreas
- T4 associated with increasing OR of more organ donation than T3

Rosendale Transplantation 2003
Evidence for hormonal therapy

<table>
<thead>
<tr>
<th></th>
<th>graft loss</th>
<th>graft dysfunction</th>
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</thead>
<tbody>
<tr>
<td>Hormonal therapy</td>
<td>3.8%</td>
<td>5.6%</td>
</tr>
<tr>
<td>No hormonal therapy</td>
<td>7.9%</td>
<td>11.6%</td>
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</tbody>
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- UNOS study of 4543 heart recipients
- 46% reduced odds of death in 30 days

Rosendale, Am J Transplant 2002
Hemodynamic Goals

- MAP ≥ 60 mmHg
- CI ≥ 2.4 L/min.
- UOP ≥ 1.0 cc/kg/h
- LV EF ≥ 45%
- Normal pH
- WATCH out – 80% of brain dead patient are hypotensive

(Nygaard J Trauma 1990)
Care for the potential organ donor

• **STEP #1:** Assess hemodynamic status
• Is patient hemodynamically unstable?
• Bolus with 10 cc/kg of NS, continue to goal SBP>90 mmHg or MAP>60 mmHg and UOP>1 cc/kg/h
• Use colloids if patient actively bleeding (pRBC, FFP etc)
• Ensure central line and A line in place
• Begin vasopressors if necessary and begin hormonal therapy (if pt has 1st brain death exam)
• Order TTE
Care for the potential organ donor-Hormonal Resusitation

- **STEP #2**: Treat endocrine failure/panhypopituitary state
- Synthroid drip
- Pitressin drip 25 u in 250 cc NS
  - 1 u Pitressin bolus
  - 0.5 u /h titrate to max of 4-6 u/h
- Insulin drip to maintain BG 80-150 mcg/dL
- Start 15 mg/kg Methylprednisolone q 24 h
- For all brain dead patients
Care for the potential organ donor

- **DI watch:**
  - Check for UOP ≥5 cc/kg/h x 2 hours
  - Urine specific gravity <1.005
  - Serum Na>145
  - Serum Osm >305
  - In absence of diuresis or contrast

- If DI detected-> Pitressin 0.5 u IV titrate to UOP 1-2 cc/kg/h, max 4-6 u/h

- Avoid D5W- hyperglycemia causes osmotic diuresis and worsens problem
Special Consideration: Cardiac

- Check TTE
- If EF<45% and MAP<60
  - consider adding inotropc agent (dobutamine, milrinone)
  - Repeat TTE after maneuvers
  - Consider PA catheter or noninvasive CI monitoring (flotrac, lithco)
- If EF>45% and MAP<60
  - Add Levophed or Neo
- If EF unknown, titrate synthroid, Pit, option for Levophed or Neo
- Some patients will experience neurogenic stunned myocardium after brain death: this is potentially reversible
- INITIAL LOW EF MAY NOT PRECLUDE CARDIAC DONTATION
Heart Donation

- Need cardiac cath
- Cath and bronch are considered emergency procedures and should not be delayed
- Longer medical care led to lower yield of cardiac allograft

(Cantin Transplantation 2003)
Special Considerations: Lung

- Rate of lung recovery lower than other organs
- Solumedrol 15 mg/kg led to better oxygenation and lung yield than nonsteroid tx pts (Follette J Heart Lung Transplant 1998)
- Early donor network contact and steroids predict lung donation (McElhinney Clin Transplant 2001)
Lung donation

- TV 8-10cc/kg, 6 cc/kg if ALI/ARDS
- Avoid atelectasis with PEEP≥5
- Solumedrol 15 mg/kg qd
- Empiric Zosyn
- Adjust vent per ABG
- Need bronch
- Daily CXR
- Need PF ratio >300,
- plateau press<30
- Minimally positive fluid balance best for lung donation (Reilly Chest 1996)
Lung Recruitment

- If decreased pO2 or CXR with atelectasis:
- Increase PEEP to 30 x 30 seconds (dial up over 5-10 seconds)
- Return to previous setting and repeat in 5 min.
- Recruitment strategy not shown useful in ALI/ARDS patients (Meade JAMA 2008)
- Perform post bronch and apnea test
- Beware temporary hypotension with increased PEEP
- Bronch for mucous plugging as needed- do not do washings
Data on lung strategy

- Early bronch, frequent suctioning, targeting ventilation at lung expansion
- Increase lung procurement

(Gabbay J Resp Crit Care Med 1999, Cummings J Transplant Coordination 1995)
Donation after Cardiac Death
Definition

- Cardiac death “irreversible cessation of cardiac and respiratory function”
- Brain death “Irreversible loss of function of the entire brain, including the brain stem”
- ¾ of organs transplanted are recovered from deceased donors.
- Typical DCD donors have devastating neurologic injury but have not progressed toward brain death
- Or have terminal illness and wish terminal wean
Outcomes

• Organs transplanted from DCD have similar outcomes to DND
• 30 min. from death to liver harvest
• 60 min. for kidney, pancreas
Institute of Medicine Report: Recommendations

- All Organ Procurement Organizations (OPOs) should explore DCD in cooperation with local hospitals, health care professionals, and communities. A protocol must be in place in order for DCD to proceed.
- The decision to withdraw life-sustaining treatment should be made independently of and prior to any staff-initiated discussion of organ and tissue donation.
- Statistically valid observational studies of patients after the cessation of cardiopulmonary function need to be undertaken by appropriate experts.
- DCD should focus on the patient and the family.
- Efforts to develop voluntary consensus on DCD practices and protocols should be continued.
- Adequate resources must be provided to sustain DCD in order to cover the costs of outreach, education and support for OPOs, providers and the public, as well as any increased costs associated with DCD recovery.

Institute of Medicine Report: Obstacles to DCD Implementation

- Hospitals: lack of protocols, lack of interest, physician resistance
- OPO: limited financial and staff resources for training and outreach, limited technology and expertise
- Organs: concerns about organ quality, adequate organ supply without DCD donors
- Ethics: medical interventions, termination of life-sustaining treatment, determination of death
Surgeon Accused of Speeding a Death to Get Organs

By JESSE MCKINLEY
Published: February 27, 2009

SAN LUIS OBISPO, Calif. — On a winter night in 2006, a disabled and brain-damaged man named Ruben Navarro was wheeled into an operating room at the Torrance Memorial Medical Center.
LOS ANGELES - A surgeon was charged Monday with prescribing excessive drugs to a comatose, disabled patient to hasten his death and harvest his organs for transplantation.

Prosecutors in San Luis Obispo County said Dr. Hootan Roozrokh, 33, of San Francisco, gave a harmful drug and prescribed excessive doses of medications.

Civil suit Settled for $250,000

“In the most shocking accusation, the complaint said Dr. Roozrokh introduced Betadine, a topical antiseptic into Mr. Navarro’s system” - NY Times

Felony Criminal Charges: Dependent Adult Abuse Mingling a harmful substance Prescribing a controlled Substance without medical purpose
Decisions to withdraw and withhold life-sustaining treatment should be made independently from any consideration regarding organ and tissue donation;

Policies should explicitly differentiate the process of withdrawing and withholding life sustaining treatments, the declaration of death by cardiopulmonary criteria, and the retrieval of organs;

Health professionals with ethical objections to the practice of DCD should be allowed to decline to participate; and

The provision of compassionate end of life care for the patient, and appropriate support for the family, should be a critical aspect of the DCD protocol.
Process

1. Decision to withdraw treatment
2. Assessment for DCD
3. Withdrawal of treatment
4. Pre-mortem interventions (morphine drip etc)
5. Cardiac arrest and organ retrieval
Protocol for Organ or Tissue Donation after Cardiac Death

Revised in accordance with DOH letter dated April 2007
1. Decision for Withdrawal of Life Sustaining Therapy

- Family/patient decides based on patient wishes to withdraw care.
- This occurs prior to any discussions regarding organ donation - there should be a clear separation between withdrawal and donation discussions.
- Only NYODN staff should approach the family for donation discussions.
- DNR should be documented.
- Withdrawal conversation documented.
2. Eligibility for DCD

- Contact NYODN (MD, RN)
- NYODN will assess patient for DCD
- No family discussion re: DCD will occur until NYODN has determined suitability for transplant
3. NYODN approves suitability

- NYODN coordinator approaches family and explains procedure and transplant process
- If consent obtained, pt assessed for likelihood of arrest in 1 hour
- Patient disconnected from vent (SBP or PS 5) for up to 10 min. and VS monitored
- Patient may receive heparin during procurement and family should be informed
- Other procedures prior to transfer to OR (lines etc) solely to promote organ preservation are discouraged
- If pt not likely to arrest in 60 min. family informed—may be reasonable to proceed to OR anyway
4. Consent

- NYODN consent form used and placed on chart
- NYODN obtains consent, answers questions, informs family about possible heparin use
- Family informed that if pt does not arrest in 60 min. after withdrawal, he/she will be returned to ICU bed
- Health care agents can consent to pre-mortem procedures to the extent that these are comensurate with pt’s wishes
- Copy of consent placed in chart
5. Transferring patient to OR

- NYODN will arrange time of organ recovery based on:
  - Family’s wishes
  - OR schedule
  - Organ recovery team
- OR nursing director/coordinator will be notified
- The anesthesia attending on call will be notified and briefed by attending physician or designee prior to transfer to OR
- Anesthesia team should be aware that primary care team may administer comfort care meds in OR
5. Transferring patient to OR

- The patient transported to the OR by the ICU nurse, primary team
- If the patient has a cardiac arrest prior to transfer to the OR - no CPR
- Orders prior to OR:
  - Continue meds from ICU
  - Order for transport, monitoring and sedative/pain meds
  - Order for heparin
  - Additional meds for comfort procured from ICU/PACU nurse or anesthesia
5. Transferring patient to OR

- The family may accompany pt to OR but must leave after patient declared dead.
- A space should be made in OR for family members who wish to be present.
- Bed must be saved in ICU or floor in the case that the patient does not arrest.
6. OR care

- Patient will be prepped and draped prior to extubation to minimize ischemia time
- This will be explained to the family as part of the consent process
- The organ harvesting team will leave the OR after patient preparation and will not return until after death is declared and the family has left the OR
- Any physician or staff member with ethical objections may decline to participate in DCD but should find a replacement
6. OR Care

- Titration of sedation pre and post extubation may be made jointly by ICU team, or anesthesia.
- Sedative/analgesic drips begun in ICU may be continued or may be initiated in OR.
- Titration of drips should not be influenced by possibility of organ donation.
- Suggested titration targets include HR<100 and/or RR<20.
- The physician titrating the comfort medications SHOULD NOT be part of the transplant team.
- It is the primary care team’s responsibility to titrate medications.
- Anesthesia is present to facilitate and assist the primary team in this goal.
- Primary care team, or anesthesia will withdraw life sustaining treatment.
6. Pronouncement of Death

- 5 min. must pass after cardiopulmonary arrest before legal declaration of death
- Must arrest within 60 min. of withdrawal
- Pronouncement of death may be made by primary care team (attending or designee), or anesthesia
- The declaring physician must not be part of organ retrieval/transplant team
- Death certificate must be filled out
- Family notified
7. Patients Found Ineligible

- If no cardiac arrest in 60 min. pt returns to ICU or floor bed and comfort care continues
- If pt expires in ICU or on floor primary team must declare death and fill out death certificate
8. Cost

- NYODN will be responsible and billed for all costs related to medical suitability and recovery of organs.
Conclusions

• There is a gap between organ supply and demand
• DND organ yield can be increased with hormonal therapy
• DCD is an option for patients with planned withdrawal of life sustaining measures
• Collaborative teamwork is necessary to provide patient and family support during DCD
Don’t take your organs to heaven... heaven knows we need them here!

WWW.donatelif.org
NYS organ and tissue donor registry
Care for the potential organ donor

• **STEP #2: Assess hemodynamic status**
  • Is patient hypovolemic?
    – CVP < 4 mmHg (OPTION use SVV, evidence from echo)
    – UOP < 0.5 cc/kg/h, SBP < 90 mmHg
    – Fluid deficit ≥ 2 L in 24 h
  • If volume depleted:
    – Give 2-3 cc/kg/h until CVP 6-8
    – If Na < 155 use NS
    – If Na 156-164 use ½ NS or free H2O boluses enterally
    – If Na > 165 use D5W or free H2O boluses enterally
    – Maintenance fluids at 1.5-2 cc/kg/h goal CVP 6-8, SVV < 13
Care for the potential organ donor - Hormonal Resuscitation

- Prepare Synthroid drip
  - 200 mcg T4 in 500 cc NS
  - 20 mcg bolus
  - Start 10 mcg per hour (do not exceed 20 mcg/h)
  - Titrate up/down as necessary

- Give 10 u insulin with 1 amp of D50 (unless BG>300) prior to initiating synthroid
  - Synthroid drip causes hyperkalemia
1. Withdrawal of Life Sustaining Therapy

- Family decides based on patient wishes to withdraw care
- This occurs prior to any discussions regarding organ donation
- Health care agents can consent to pre-mortem procedures to the extent that these are commiserate with pt's wishes
- Extubation will occur in the OR by the patient’s attending physician or designee (licensed resident or fellow)
- This may be an anesthesia, critical care, palliative care or primary team attending
- Any physician or staff member with ethical objections may decline to participate in DCD but should find a replacement
2. Eligibility for DCD

- Contact NYODN
- Palliative Care consult should be called
- decision for withdrawl documented by primary team and pall care team
- NYODN will assess patient for DCD
- No family discussion re: DCD will occur until NYODN has determined suitability for transplant
- Patient should be made DNR with documentation
3. NYODN approves suitability

- NYODN coordinator approaches family and explains procedure and transplant process
- If consent obtained, pt assessed for likelihood of arrest in 1 hour
- Patient disconnected from vent (SBP or PS 5) for up to 10 min. and VS monitored
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