

## **DCD Lung Donation: Single Center Update**

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## **Rationale for Donation after Cardiac Death (DCD)**

- Transplantation is usually performed using brain dead donors.
- Many potential donors expire without meeting brain death criteria.
- Donation after cardiac death (DCD) may significantly increase the available pool of donor organs.

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## **Increasing the Donor Pool**

- use of “suboptimal/marginal” donors
- DCD donors
- Ex vivo perfusion devices
- Mechanical and Biologic alternatives

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### DCD Donors

- DCD=donation after cardiac death (patient is NOT “brain dead”)
- Support withdrawn in planned fashion, donor allowed to expire (controlled DCD)
- Organs harvested after asystole/electrical silence achieved
- Warm ischemia inherent to DCD donation

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### DCD: the past

- First successful heart (Barnard) and first successful lung transplant (Hardy, 1963) in humans used DCD donors

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### Heart Transplant-DCD

- Christian Barnard 1967
- Donor-victim of trauma, no brain death established
- DCD harvest
- Recipient expired POD #18 (pneumonia)



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## Lung Transplant-DCD

- Recipient: 58 yo M with unresectable lung cancer
- Donor: died of large MI-family consented to donation
- IV heparin given after death declared (DCD donor!)
- Left lung procured in adjacent OR
- Individual PV anastomoses
- Tracheostomy performed at end of transplant




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- Postoperative angiogram showed patent PA and PV anastomoses
- Pt died of renal failure POD #18 (hx glomerulonephritis-no HD available)
- Autopsy-no lung rejection

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## DCD-PRO: Brain dead donors may be “bad”




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### DCD-Lungs

- Lungs are not solely dependent on perfusion for aerobic cellular metabolism.
- Passive diffusion occurs through alveoli for substrate delivery; lungs can tolerate warm ischemia for several hours.
- Experimentally, more ischemia-reperfusion injury occurs in donor lungs from brain dead donors than DCD donors.
- ? Reperfusion injury, graft dysfunction

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### DCD-Hearts

- Obligate period of warm ischemia of more concern
- Distension and thrombus formation also considerations
- ? Reperfusion injury, graft dysfunction

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### DCD Donors: The Present

- DCD protocols exist for recovery of kidney, liver, and to a lesser extent lungs and hearts; cardiac DCD has been reported in Europe and USA
- Practical reality: Frequency/prevalence of DCD donations will only *increase*

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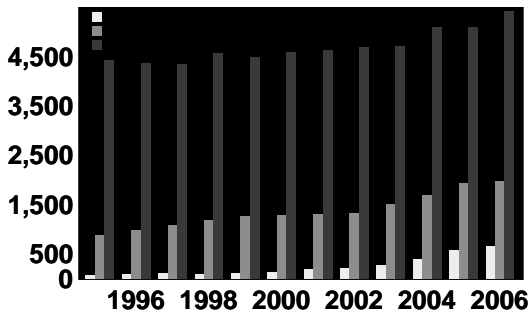
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**Distribution of Deceased Organ Donors in U.S., 1995 - 2006**



Steinbrook R. N Engl J Med 2007;357:209-213

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**DCD Cardiac Donors**

- Anecdotal experience of successful heart transplantation using DCD donors
- Experimental success achieved
- U. of Colorado: reported 3 children alive at 3m,6m,3y after heart transplant with DCD donor
- Role of DCD not established

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**DCD Lung Donors**

- 36 cases of DCD lung transplant through 2007
- Limited single center experiences only have been reported

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### Lungs and DCD: PRO

- Lungs are not solely dependent on perfusion for aerobic cellular metabolism.
- Passive diffusion occurs through alveoli for substrate delivery; lungs can tolerate warm ischemia for several hours.
- Experimentally, more ischemia-reperfusion injury occurs in donor lungs from brain dead donors than DCD donors.
- DCD organ donation is increasingly utilized in solid organ transplantation.

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### Lungs and DCD: CON

- The DCD donation process may result in aspiration.
- Asystole and warm ischemia may cause post-operative graft dysfunction.
- Use of DCD lung donors may result in poorer outcomes.

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### Hypothesis

- Outcomes with DCD lung donors will be comparable to those with brain-dead (non-DCD) lung donors.

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## Study Aim

- Define early postoperative outcomes in recipients of DCD lungs at a single institution.

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## DCD Lung Evaluation

- DCD lung donor criteria: *same as for brain dead donors*
- CXR +/- chest CT
- Arterial Blood Gases (pAO<sub>2</sub>/FiO<sub>2</sub>>350)
- Bronchoscopy when feasible
- On-site visualization and inspection

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## DCD Policy

**On-call staff surgeon: accepts or declines organ**

**Ask OPO: is IV Heparin before withdrawal of support acceptable? (*Not allowed in Cuyahoga County*)-controversial**

**Physician at donor hospital and/or OPO coordinator administer appropriate medications**

**No paralytics**

**Interventions that preserve organ function are allowed; those that *hasten death* are prohibited!**

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**Controlled donation (Maastricht III) initiated in ICU or operating room.**

**No transplant personnel present during withdrawal of care; organ recovery team waits nearby, but outside OR**

**Ventilator support withdrawn and patient extubated; we will trach quickly if necessary.**

**Orogastric or nasogastric tube placed to prevent aspiration**

**Electrical activity monitored- 60 minutes limit; if no asystole in 60 minutes-no harvest**

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**Pt is not declared dead until after 5 minutes of cardiac arrest; after this, harvest team allowed in**

**Patient re-intubated and ventilated with FiO2 50%, low TVs (6-8 ccs/kg), 5 PEEP; bronchoscopy**

**Surgical excision lungs carried out per usual; flush as in non-DCD harvest including retrograde flush**

**What's NOT specified:**

- informed consent for DCD per se (consent for lung tx at CCF includes all risks pertaining to ALL methods of donation including DCD)
- Age limits for DCD donors

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**Cleveland Clinic:  
DCD Donor Experience**

**First DCD donor: August 2004.**

**Most recent: October 2009.**

**Total = 26 DCD lung transplants from 24 donors.**

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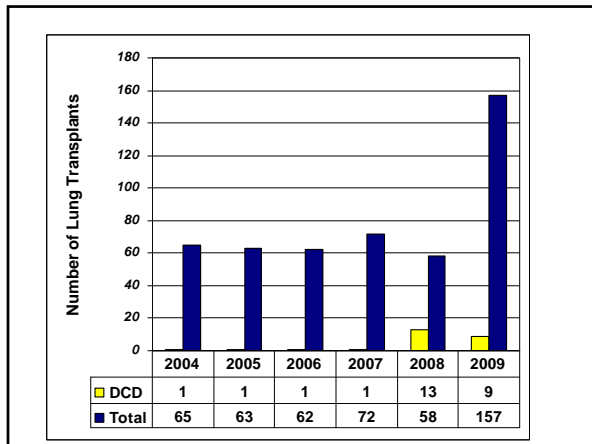
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**DCD donors: CCF experience**

**Donors (24)**

- Median age 39+/-14 years (10-59)
- 10 F, 14 M donors
- COD=9 blunt head trauma, 3 GSW, 5 CVA, 7 anoxia
- Mean tobacco use (pack-years): 6.7+/-9.6 [Median: 0+/-9.6]

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**DCD donors: CCF experience**

**Donors (24)**

- Median best PaO<sub>2</sub>/FiO<sub>2</sub>=506+/-13
- Median time to death=24+/-13 minutes (5-57)
- Median days on vent=3.0+/-1.4 days

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**DCD donors: CCF experience**

**Recipients (26)**

- Median age=59+/-12 years
- 4F, 22 M recipients
- LAS 44+/-18 (31-92, 1 ECMO)
- Median ischemic time 309+/-78 minutes
- Median PaO2/FiO2 ratio at 6 hrs = 308+/-134

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**DCD donors: CCF experience**

- Median days on vent postop 1 +/-1.8 days
- Median ICU stay 3 +/-5 days
- Median LOS 13 +/-20 days (7-114)

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**DCD donors: CCF experience**

**Early postoperative complications:**

- necrotizing pneumonia/death (1)
- PGD (n=2)
  - ECMO (1)
- colon perf->ostomy (1)

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### DCD Summary

- 2/26 total mortality with mean 1.5 years of F/U (92% survival)
- 1/25 in-hospital mortality (96% survival; death from sepsis)
- 2 significant cases of PGD->1 ECMO
- Total ischemic time similar to brain dead donors
- ICU and hospital length of stay similar to brain dead donors

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### More DCD Results

- Wash U (Ann Thor Surg 2009)
  - 11 DLTx 1/03-4/08
  - 2/11=18% in-hospital mortality
  - 4/11=36% mortality at 18 months

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### More DCD Results

- UToronto (JHLTx 2009)
  - 9 donors, 10 recipients
  - 10 LTx 6/06-12/08; 4 SLTx, 6 DLTx
  - 0% in-hospital mortality
  - PGD->ECMO (n=1)
  - 90% survival at median 270 days follow-up (1 death:sepsis)

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## DCD Summary

- **Growing experience encouraging - outcomes appear to at least be similar to those of brain dead donors**
  
- **Further experience needed to further define role of DCD lung donation**

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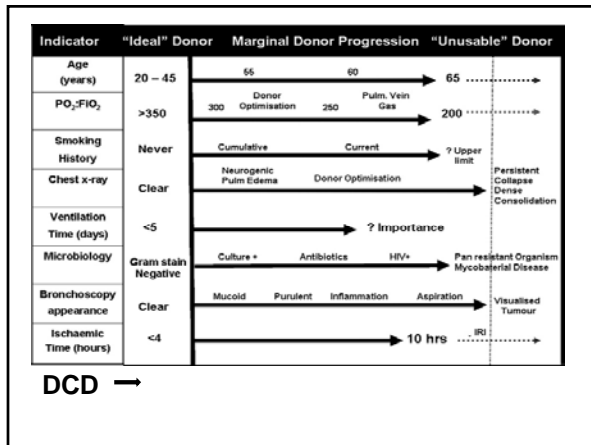
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## Future Challenges

- **Perception of DCD**
- **Donor hospital issues-reintubation, death pronouncement**
- **Long term outcomes**
- **Optimization of DCD lungs**
- **Use of hearts-?ECMO**

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## Acknowledgements-Teamwork

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- MICU and RESCU teams
- Lung Transplant pre and post coordinators; SW
- J5-5 nursing staff, J8-2 nursing staff

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