Split Myself in Two

Living Donor Liver Transplantation

UCSF Transplant

Need for Liver Transplantation

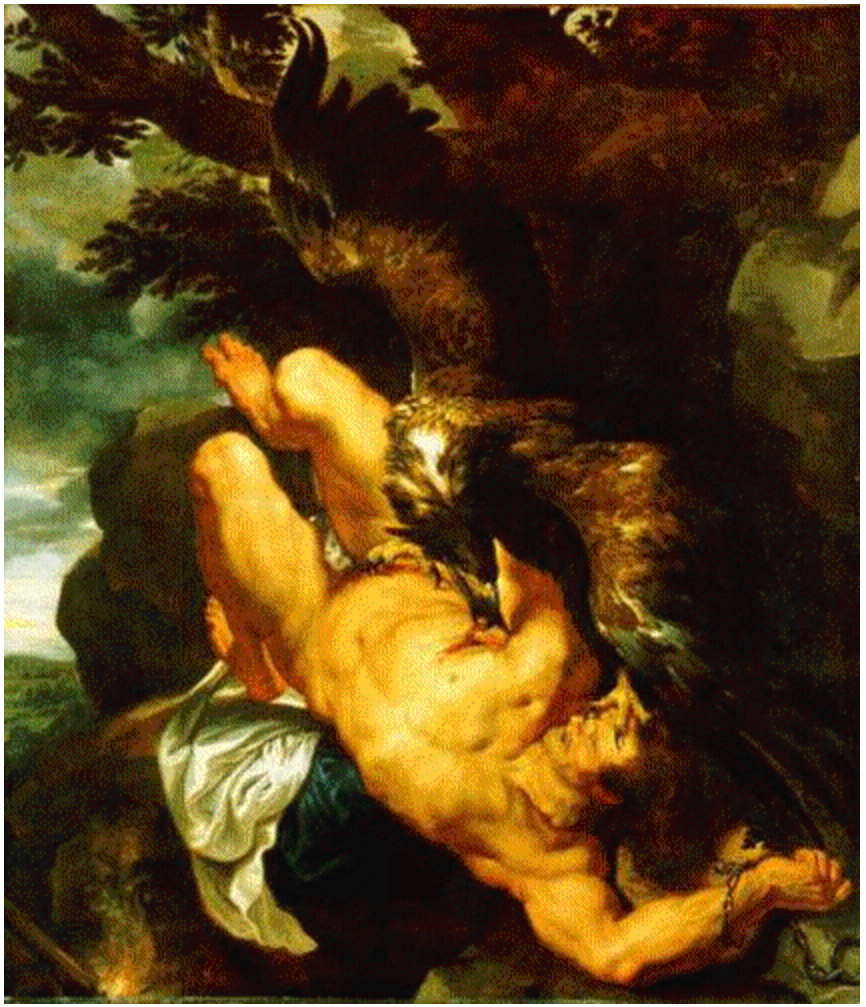
- Nationally, there are approximately 18,000 patients on the liver transplant list.
- Annually, about 6,000 patients receive a liver transplant.
- Because of the organ shortage, many patients waiting for liver transplants die on the list or become too sick to undergo transplant.
- Each year, approximately 10% of patients listed for a liver transplant in the United States die while waiting for transplantation.

UCSF Transplant

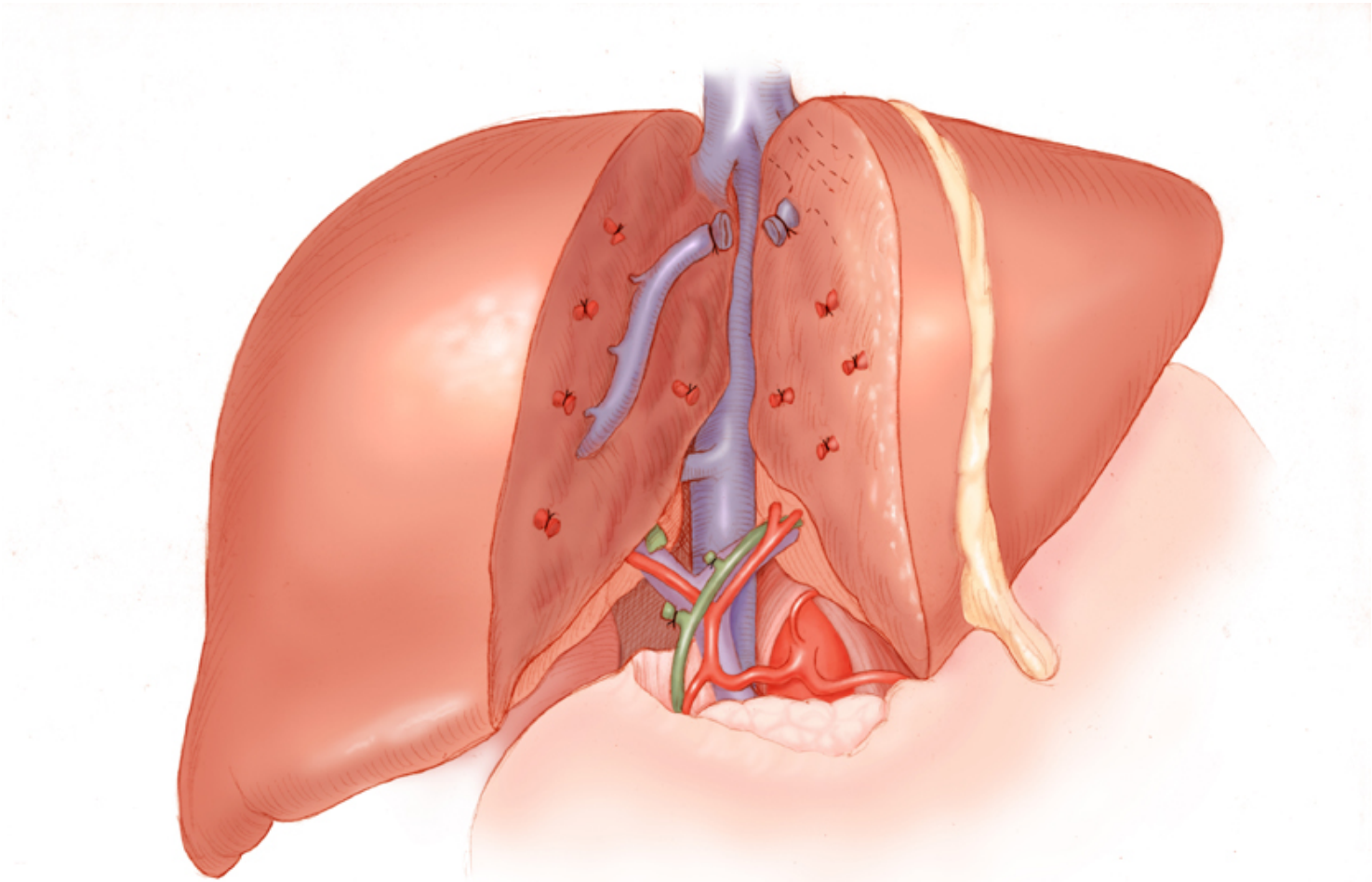
Solutions?

- Expanded criteria donors
  - Older
  - Steatotic
  - High risk
  - DCD
- Split Livers
- Living donors

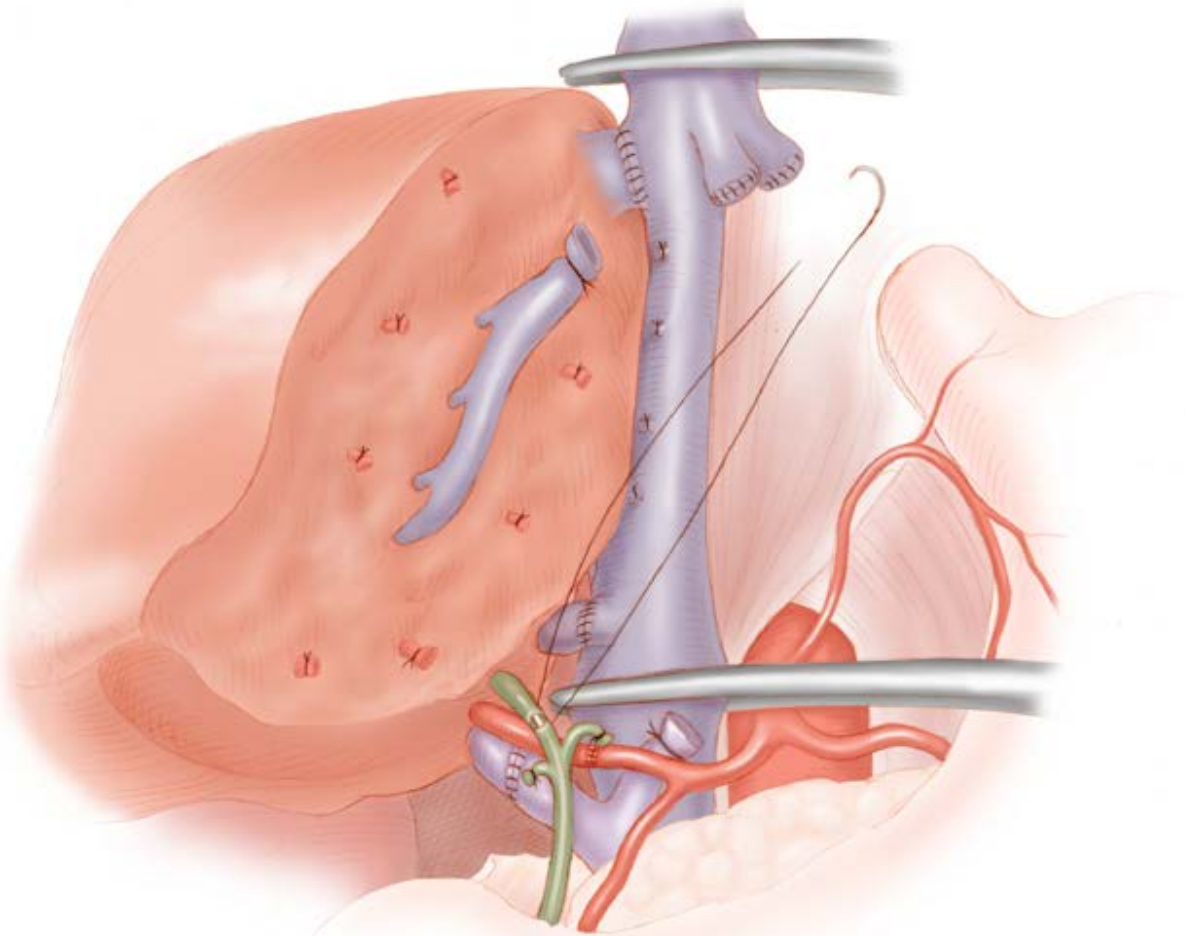
Liver Regeneration



UCSF Transplant



UCSF Transplant



UCSF Transplant

Living Liver Donation

- Living donation part of kidney transplantation since 1954
- Living liver donation began in 1989
  - Usually parents to children
  - Decreased waiting list mortality for children dramatically.
- Acceptable risk for parent

UCSF Transplant

Adult to Adult Living Donor Liver Transplantation

- First reported transplant was in 1983
- UCSF started pediatric living donor in 1992 and adult program 2000
- Currently about 3-400 living donor liver transplants are done in the US annually.

Recipient Need

Basic Principle of Living Donor Transplant

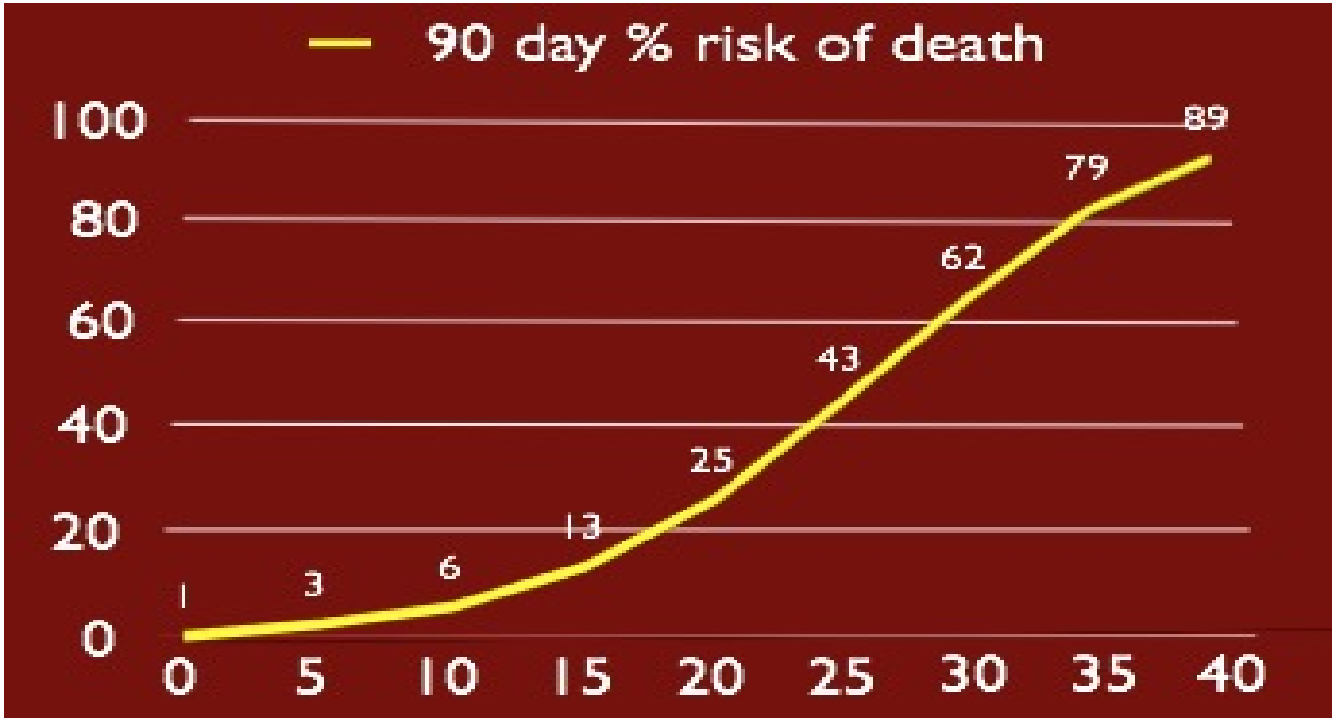
- We would not do living donor transplantation if enough deceased donor organs were available.
  - If there is a cadaveric organ available, the recipient benefit of living donation is not present; biliary complications, vascular complications, small graft
  - There is no benefit to the donor if a cadaveric organ is available

UCSF Transplant

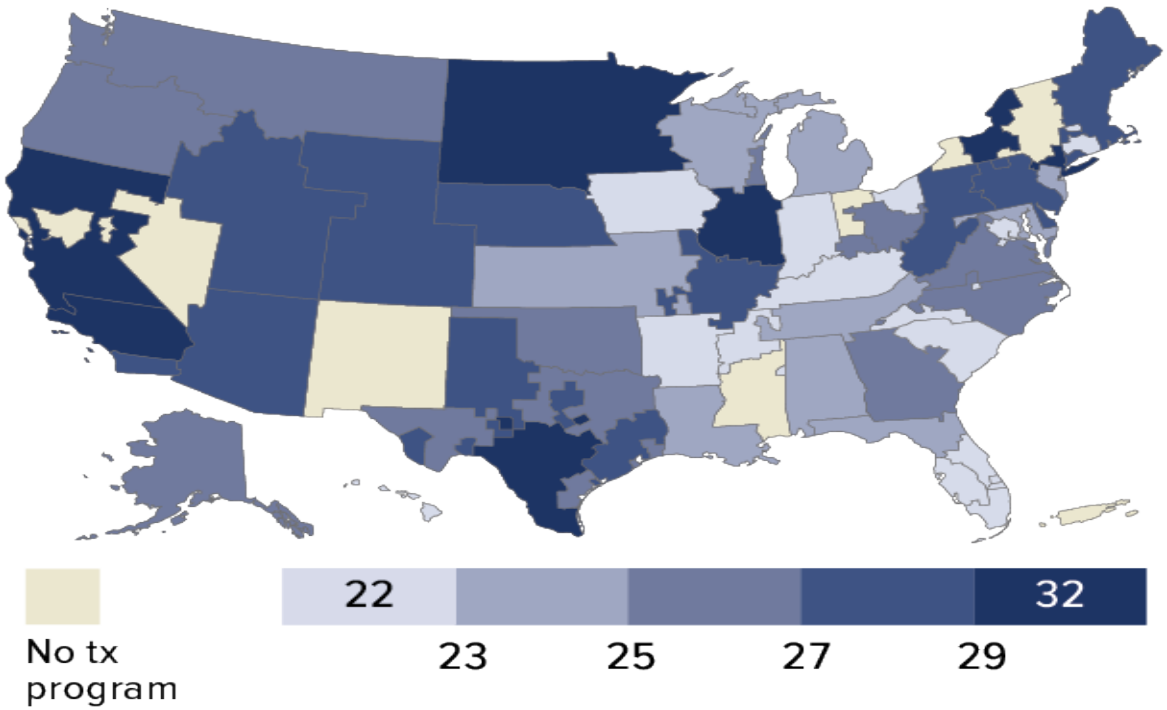
Benefit of LDLT in the United States

- Priority for liver transplantation is based upon MELD score.
- The higher the MELD score the greater the risk of death.

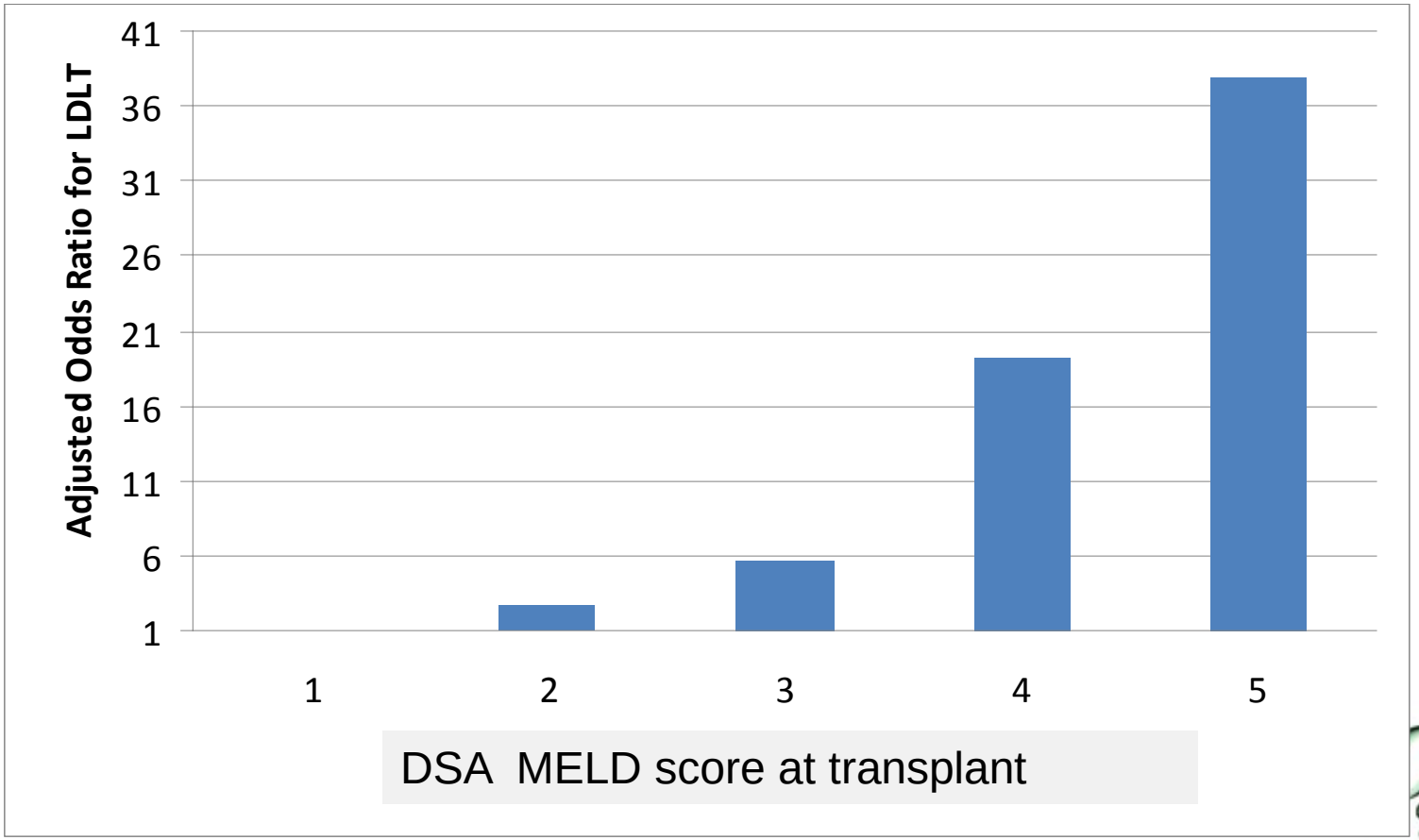
MELD Score and Risk of Death



Median MELD score for adult deceased donor liver transplants, by DSA, 2011



Availability of Donor Organ by DSA Influences Use of LDLT



UCSF Transplant

Benefit of LDLT in the United States A2ALL Study

- Patients without living donors need to get sick enough to have a high priority without getting too sick.
- The risk of death for a recipient of LDLT is less than half of the risk of a patient who doesn't have a living donor (56% lower mortality)

Berg CL et al. Hepatology 2011;54:1313–1321.

UCSF Transplant

Advantages of a live donor transplant

- The recipient does not need to wait to become sicker and weaker before undergoing a transplant.
  - The sicker the recipient the greater risk of complications after surgery and a slower recovery time.
- The advantage to the donor is knowing that he or she is helping a family member or friend who is sick and in need of a liver transplant.

Recipient Benefit

- In light of these statistics, living donor liver transplantation can be an important alternative for prospective transplant candidates.
- Depends on time to transplant and recipient degree of illness
- Benefit depends on the availability of deceased donor organs.

UCSF Transplant

Donor Evaluation Process

- If a donor is identified, a Health History questionnaire is sent to the donor.
- Health History Questionnaire is reviewed.
- An overview of the process is discussed with the donor.
- When recipient's transplant evaluation is completed and authorized, a request for the insurance authorization for the donor's work up is submitted.
- Once authorization has been obtained for the donor work up, numerous tests and procedures are scheduled at UCSF for the donor to complete.

.

Live Liver Donor Work Up

- Blood work
- CT angiogram and cholangiogram
- Abdominal ultrasound
- Echocardiogram
- Other tests depending on age and risk factors.

UCSF Transplant

Live Liver Donor Surgery

- The donor’s surgery can be 6-8 hours long.
- From the OR the donor is taken to ICU.

Live Liver Donor Surgery

- Donor remains in the hospital for 4-5 days.
- Seen for follow up the first and second week after being discharged from the hospital.
- Two months following their surgery they complete an abdominal ultrasound.
- Annual follow-up

UCSF Transplant

Donor Recovery

- Survey of donors and time to recovery.
  - 50% of the donors stated that they felt 100% by 6 weeks.
  - 75% felt 100% by 3 months
  - 25% took as long as 6 months.

Donor Risks

- Risk of death 1/100-1/1000
- Risk of complications of operation

Risk of Death

- Liver donation 1-2/1000
- Kidney donation 1/3000
- Bone marrow donation 1/10,000

1in 1000 chances of dying

- Smoking 70 packs of cigarettes
- Living 6 years in Boston
- Driving 40,000 miles in a car
  - 10,000 miles on bicycle
- Drinking one 6 pack of 12-oz cans of diet soda a day for 10 years
- Working one year as a commercial fisherman

UCSF Transplant

What is acceptable risk

- Medical community
  - Risk of death with liver donation of 1/100 was the limit
- How much risk would a donor be willing to take to save a loved one
  - 20% risk of death.

Donor Risk

- Risk of morbidity 40%
  - Infection (wound urine) 13%
  - Bile leak 7%
  - Pleural effusion 17%
  - Hernia 16%
  - Other 20%
    - A2ALL Study Group

Abecassis MM et al. Am J Transplant 2012;12:1208–1217.

UCSF Transplant

Double Equipoise

- Donor takes risk to provide recipient benefit
- Donor wants to have successful recipient outcome
- Donor wants successful donation
- Recipient wants to minimize donor risk
- Recipient wants successful donor outcome
- Recipient wants successful transplant

Siegler M et al. Liver Transpl 2006;12:358–360.

UCSF Transplant

Double Equipoise

- What is the balance between the donor risks and recipient risks?

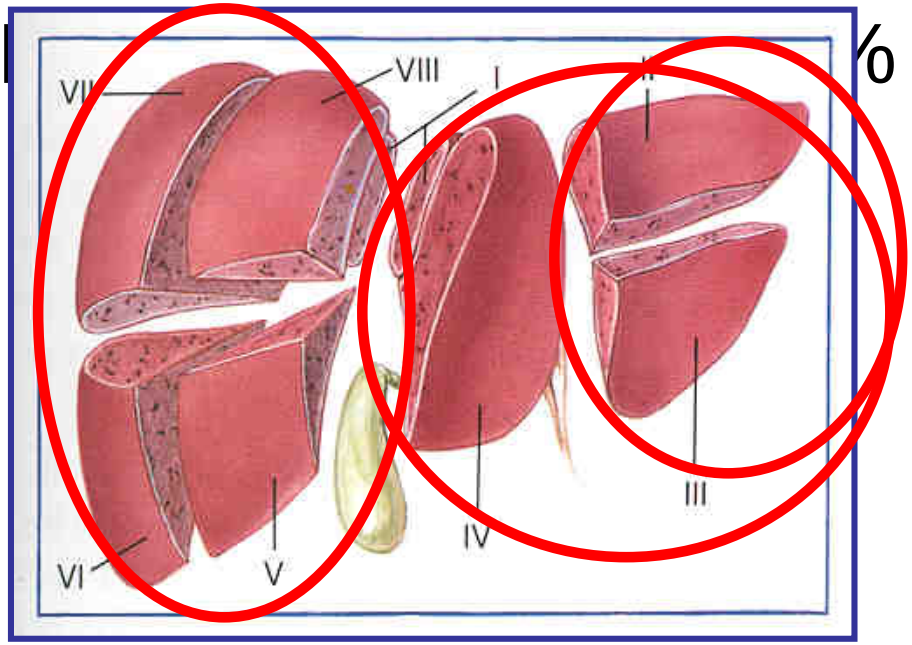
Barr ML et al. Transplantation 2006;81:1373–1385.

Minimizing Donor Risk

- Complexity of operation and amount of liver removed from the donor increases from left lateral segment to left lobe to right lobe.

Left Lobe vs. Right Lobe

- Lateral Segment 25%
- Left lobe 33%
- % of liver



UCSF Transplant

Worldwide Deaths

- Estimated 15,000 LDLT have been done worldwide
- Total deaths for LDLT =34 or 1/500
  - 30 Right
  - 4 lefts
  - Left lobe deaths =4 (1 suicide)
- United States 3200 LDLT
    - Definitely related to surgery
      - Right 5 deaths
      - Left(lateral segment) 1 death
    - 1/600

Pomfret Personal communication

UCSF Transplant

Comparison of Donor Complications by Graft

- 10 studies comparing complications by graft type
  - 3 studies suggest RH=LH; 7 suggested RH>LH
  - 2 of 3 studies had <3% donors RH
- Lateral segment safest
- Complications of left lobe grafts 25-50% of rate of right lobe grafts
- Higher rate of biliary complications in RL donation

UCSF Transplant

Recipient Benefit/Risk

Right vs. Left Lobe Grafts

- What is the relative benefit of a left lobe vs. right lobe graft to the recipient?
- What role does graft size play in outcome?

UCSF Transplant

Left vs Right Lobe

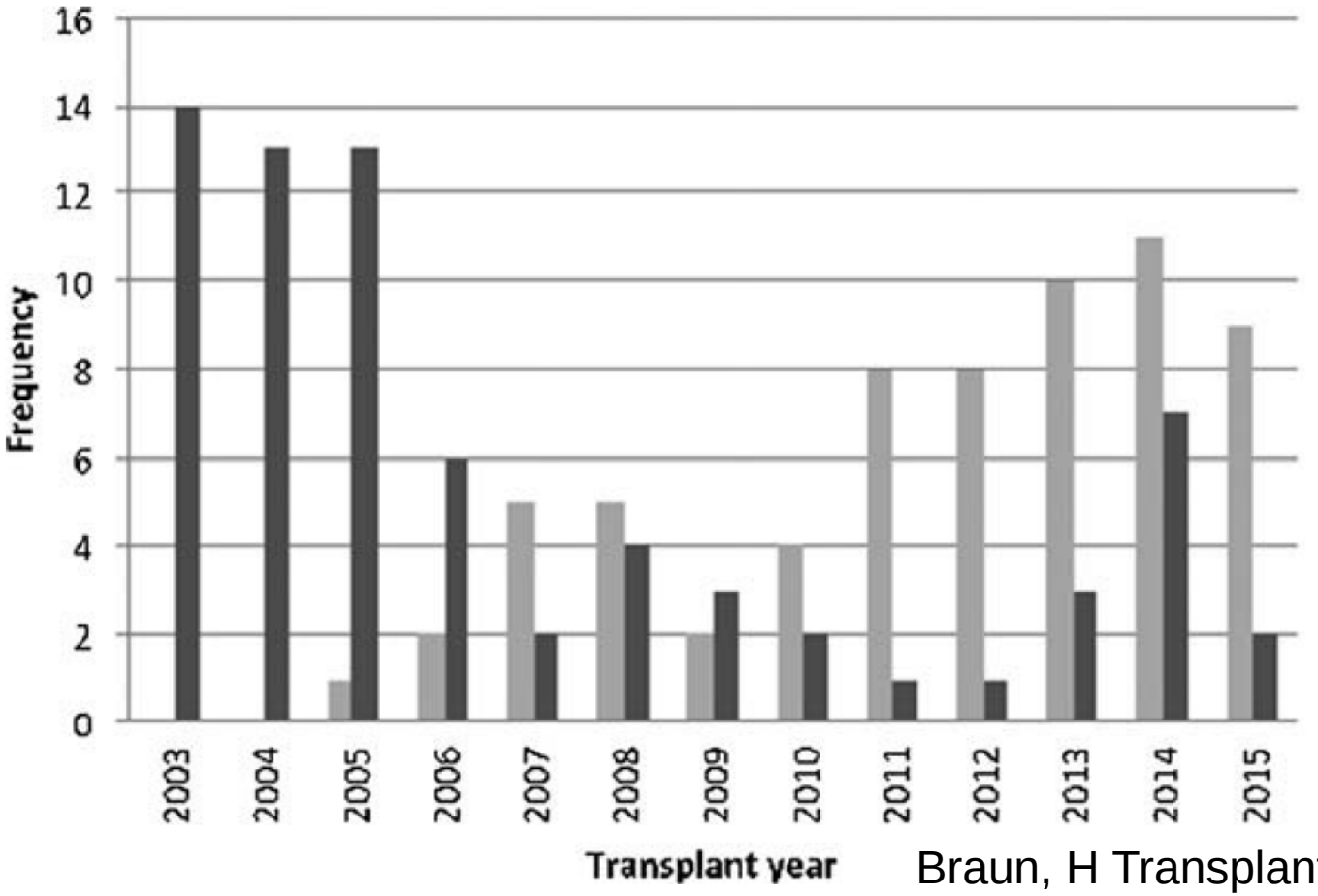
- At some point graft becomes too small and recipient outcome suffers

Small Graft Outcome

- 33 patients received grafts <35% of GW/SLV vs 87 patients with GW/SLV of >35%
  - No difference in 1,3 or 5 year survival
  - No difference in INR, bilirubin or ascites production
  - Ikegami Liver Transpl 2009
- GW/RW not predictor of outcome.
  - Selzner Liver Transpl 2009
- GW/RW not predictor of outcome.
  - Hill Liver Transpl 2009

UCSF Transplant

UCSF Adult to Adult Living Donor Liver Transplantation



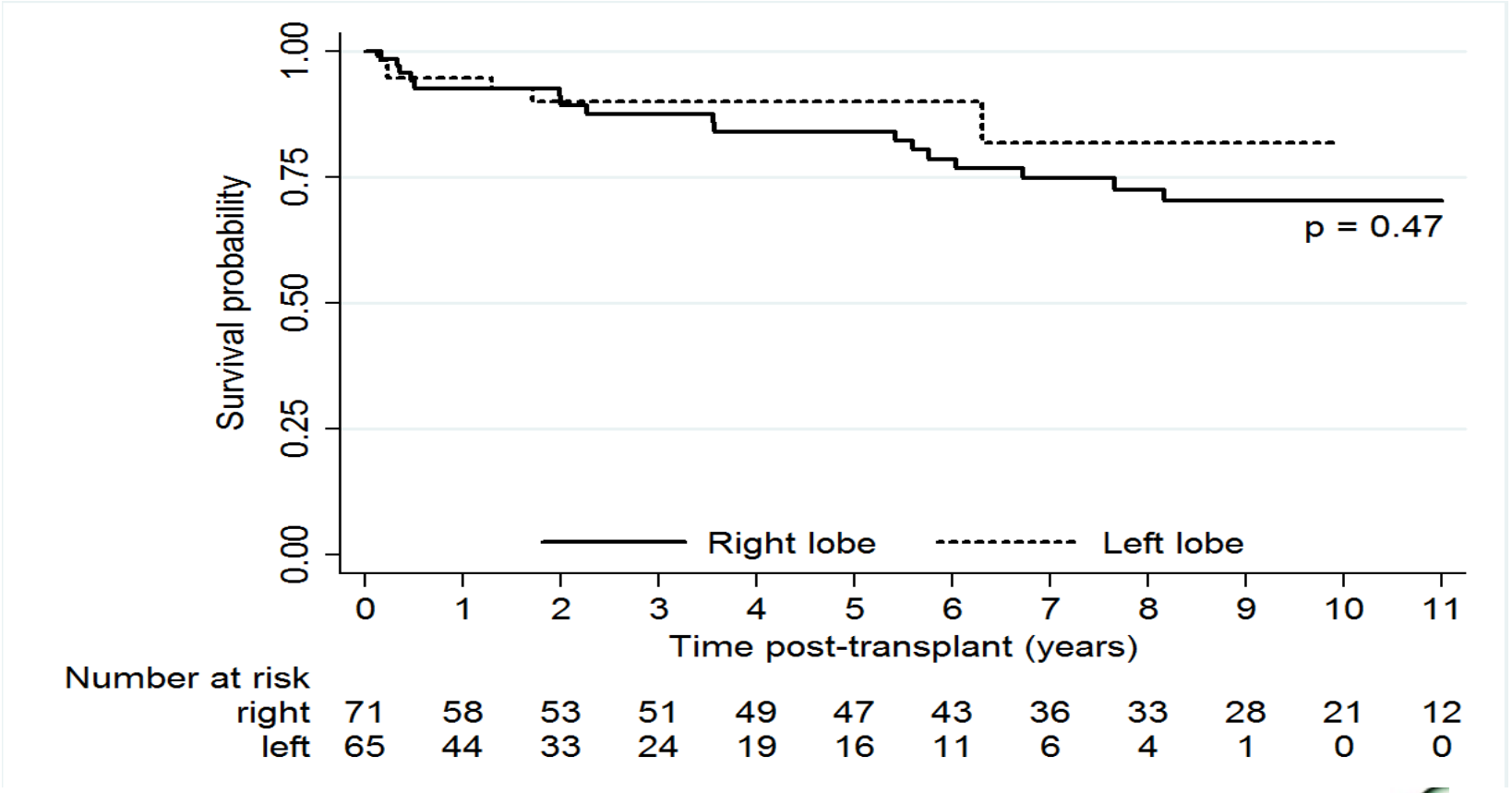
66

71

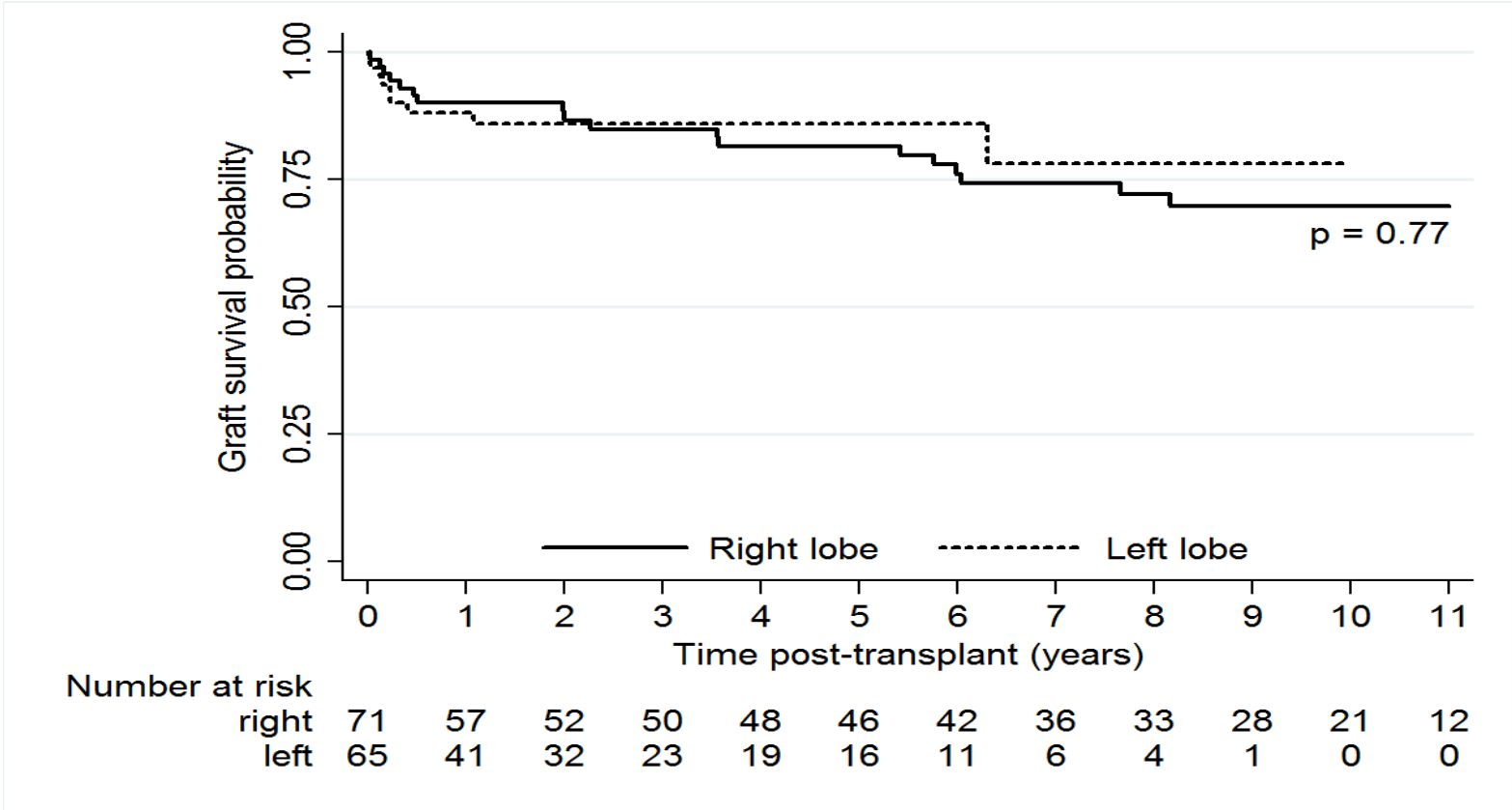
Braun, H Transplantation 2016

UCSF Transplant

Results – Recipient Patient Survival



Results – Recipient Graft Survival



Graft Size-Overall

	Overall	Right	Left
N	136	72	64
Graft weight/recipient weight (mean±SD)	0.8±0.3	1±0.3	0.6±0.15
Graft weight/standard liver volume (mean±SD)	0.41±0.16	0.51±0.13	0.31±0.1

Unpublished data courtesy of Prof Roberts

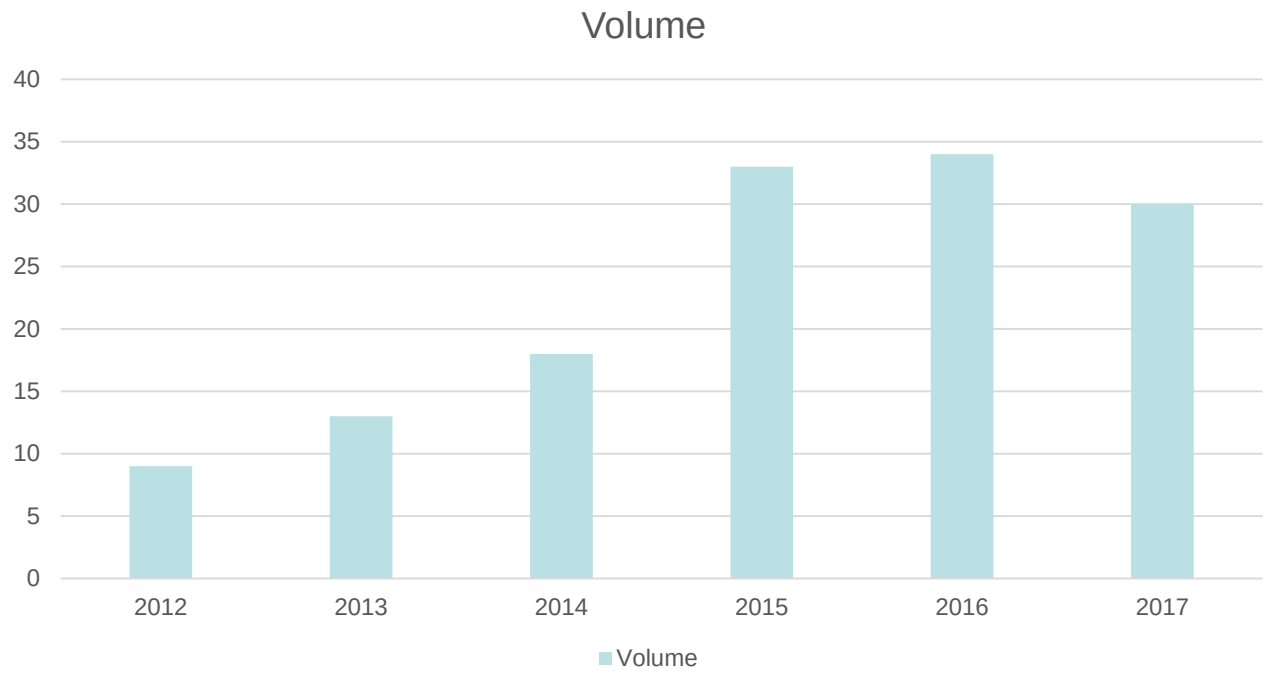
UCSF Transplant

Results – Donors Right vs. Left

	Overall	Right	Left	P-value
Age*	33 (27-42)	37	30	0.001
Gender (% male)	50%	52%	47%	0.70
Weight (kg)	79	80.4	76.6	0.20
Graft size (cc)*	700 (450-800)	800 (700-955)	450 (400-500)	<0.001
Residual liver volume per SLV*	0.51 (0.38-0.74)	0.39 (0.33-0.47)	0.7 (0.65-0.91)	<0.001
Length of stay (days)*	7 (6-8)	7 (7-8)	7 (6-7)	0.001
Complications	20%	24%	14%	0.26
Readmission	19%	23%	14%	0.05

* Median (IQR)

UCSF LDLT Volume



Why the LDLT Increase

- Recognition of risk of death of low MELD patients
- Median MELD at transplant >30
- Progression of patients from low MELD to high has risk of death

Increase in LDLT

- Frank patient discussion about risk of death without LDLT
- Decreased barriers for donors to come forward
- Ability to use left or right lobes decreases anatomic rule outs

Tension

- Balance of donor risk and recipient benefit
- Shift some risk from the donor to the recipient but have the right balance

Summary

- Patients die waiting for liver transplants
- Right lobe living donation has more risk than left lobe donation
- Small-for-size syndrome and graft failure increases the risk to the recipient of the left lobe graft
- Portal decompression appears to decrease the risk of left lobe graft.
- Risk is now shifted from donor to recipient

UCSF Transplant