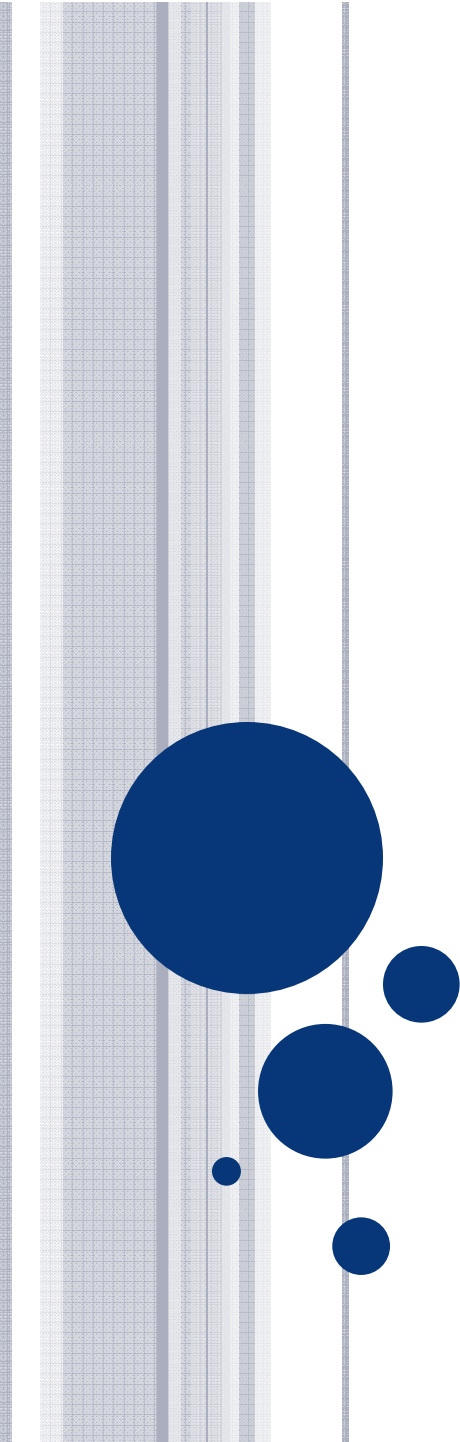




Adult-to-Adult Living Donor Liver Transplant

Anju Sidhu MD
University of Louisville
Gastroenterology, Hepatology, and Nutrition
November 1 2012

POP QUIZ

○ How many LDLT have been performed in the US?

■ < 500

■ 500 – 1000

■ > 1000

	LDLT	DDLT
Adults	3,246	100,447
Pediatrics	1,434	11,987
Kentucky	1?	1,267
New York	828	7,650



Left Lobe Graft



OUTLINE

- Historical Perspective
- Define the Need
- Donor Selection and Testing
- Grafts
- Liver Regeneration
- Donor Safety and Complications
- Recipient Outcomes
- Future



HISTORY

- 1963 : First human liver tx (3yo)
- 1980's : Immunosuppression
- 1989 : Successful adult-to-child living donor
- 1993 : Adult-to-adult living (A2ALL) with R lobe
- 2000 : Dual grafts A2ALL in South Korea
- 2002 : MELD/PELD



Dr. Russell Strong

- ~40 US Centers

Transplant leaders

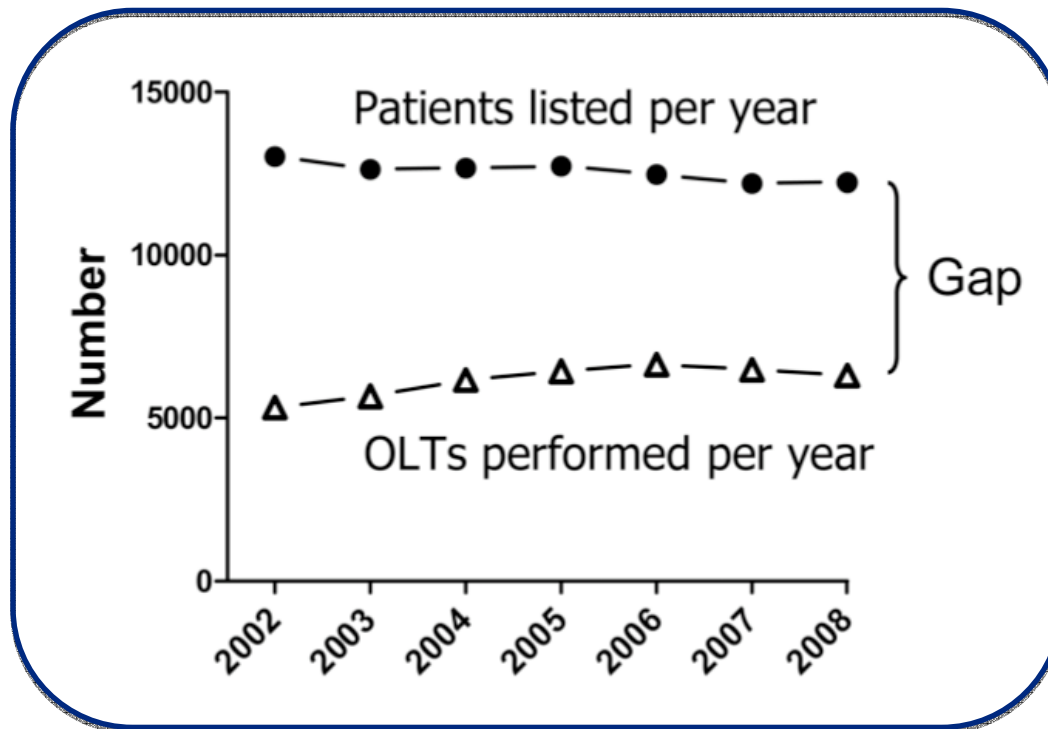
The 12 hospitals doing the most living donor liver transplants since 1988:

HOSPITAL	NUMBER
1. Mount Sinai Medical Center, New York	237
2. University of California/San Francisco	201
3. Lahey Clinic Medical Center, Burlington, Mass.	199
4. New York Presbyterian/Columbia	182
5. Strong Memorial Hospital, Rochester, N.Y.	177
6. UPMC, Pittsburgh	176
7. University of Chicago Medical Center	153
8. University of Colorado Hospital	133
9. University of Minnesota Medical Center	120
10. University of Southern California Hospital	120
11. Medical College of Virginia Hospitals	116
12. Northwestern Memorial Hospital	115

Source: United Network for Organ Sharing

James Hilston/Post-Gazette

SUPPLY VS DEMAND – DEFINE THE NEED



Death on Waiting List:
~2000 - 4000 people/year

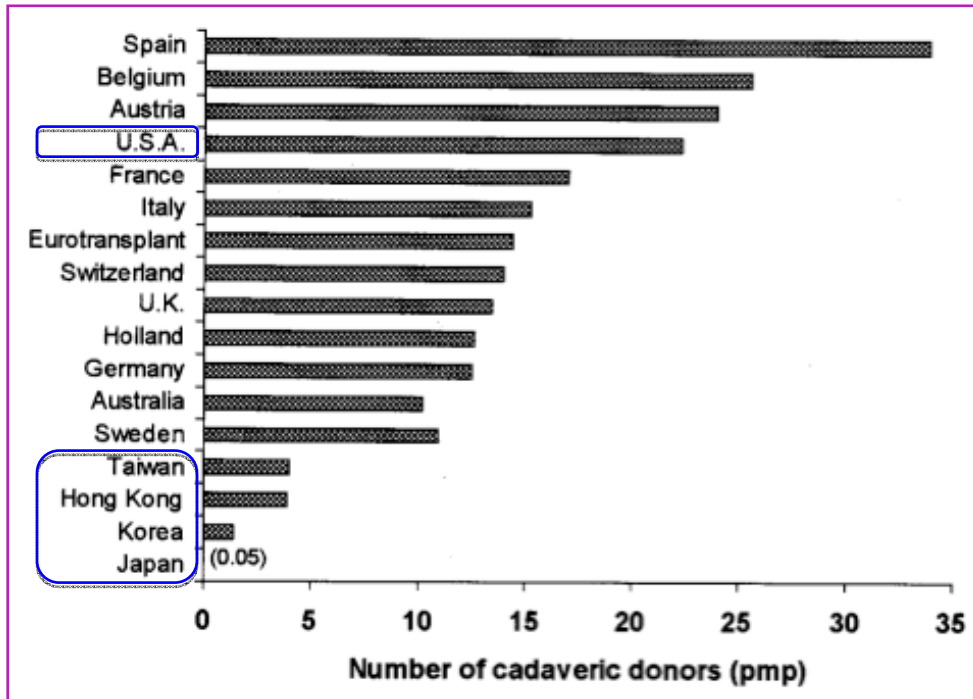
Current Waiting List : 16,075
Liver Tx in 2011 : 6,342

WAYS TO INCREASE SUPPLY

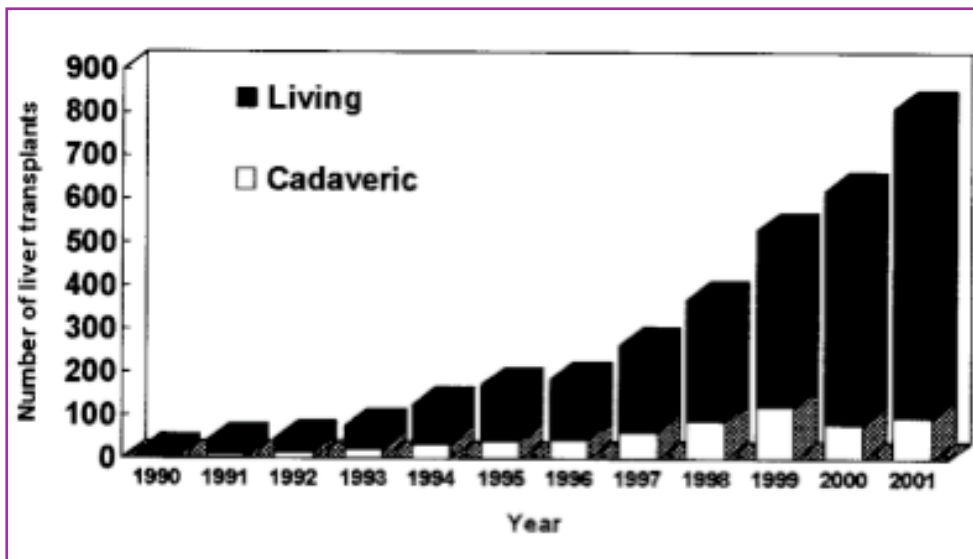
- Extended Criteria Donor
 - Older
 - Steatosis
 - HB core +
 - HCV
 - Prolonged hosp stay
- Increase Deceased Donations
 - Opt-out system
- Living Donors



LIVER TRANSPLANTS - ASIA



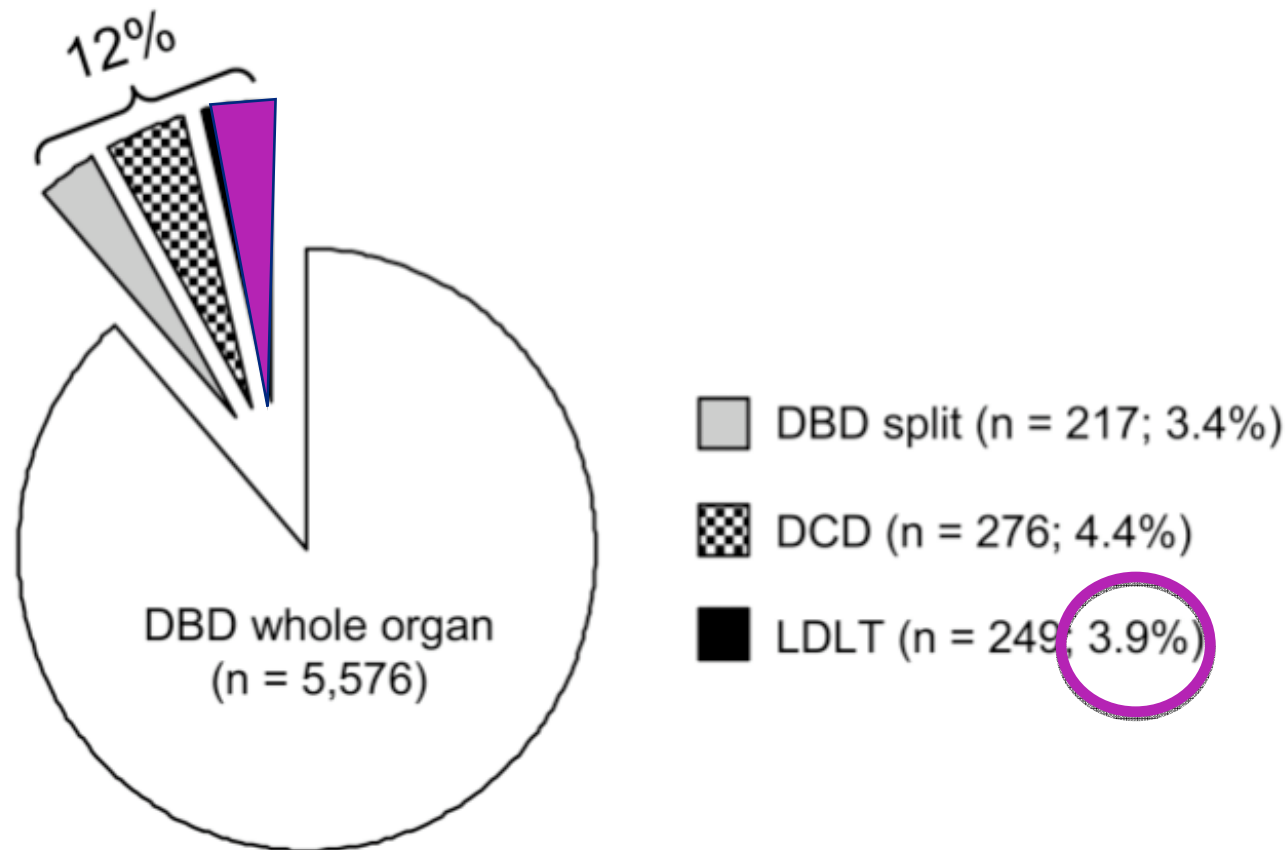
Few deceased organs
→ Lots of LDLTs



Pooled data from
~Taiwan
~Hong Kong
~Korea
~Japan

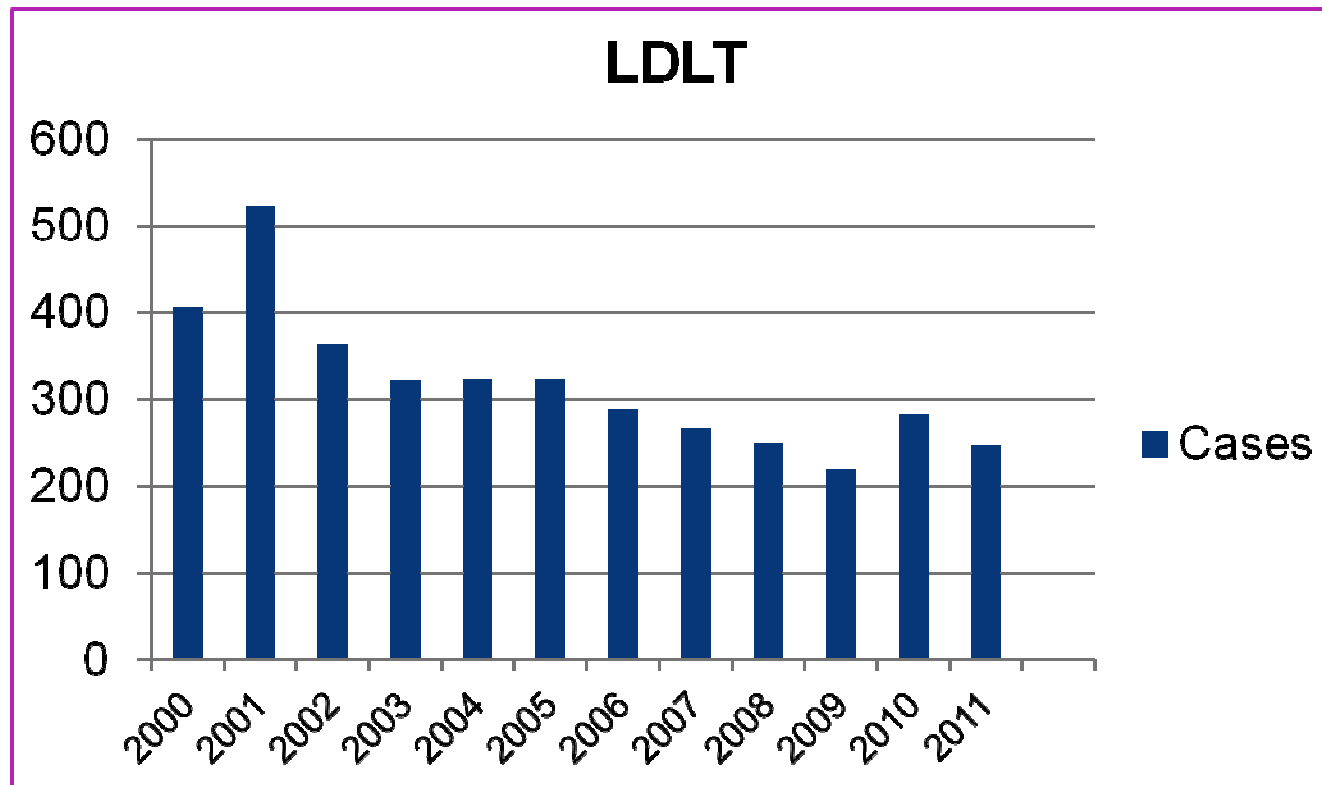
[Chen *Transplantation*, 2003 Vol 75]
[Taiwandocuments.org]

LIVER TRANSPLANTS – UNITED STATES



DBD: Donation after Brain Death
DCD: Donation after Cardiac Death
(2008 data)

LDLT - DECLINE IN US



- Increased availability using ECD grafts
- Concern for donor complications
 - Death 2002 – highly publicized
- Lack of outcome data
- Renewed interest with high-quality data (A2ALL)



DONOR SELECTION

- Generally a family member
 - Anonymous has been considered
- Age 18 – 60, BMI < 30
- Blood type – ABO compatible
- Screened for medical, psychological, and anatomical contraindications
- **Ethical Issues**
 - What is tolerable risk?
 - Education and comprehension
 - Informed consent without coercion – CHOICE?
 - Ideal recipient and timing unknown
 - Donor health privacy
 - Independent donor advocate/team



DONOR TESTING

WORK-UP

CBC, CMP, Coags

HBV, HCV, HIV, CMV

Immunoglobulins, Iron Studies

ANA, A1AT, Ceruloplasmin

Hypercoag W/U

CXR

EKG, Echocardiogram

CT/MRI Abdomen

CONTRAINDICATIONS

H/O Liver Surgery

Viral Hepatitis

Chronic Liver Disease

Coagulopathy

Malignancy

Lipid D/O

- May consider advanced cardio-pulm testing, liver bx, and/or CT angiography



TABLE 4. Evaluation process for LDLT at Duke University Medical Center

I.

Potential donor contacts transplant coordinator

Phone interview confirms age, weight, height, demographic information, blood group, medical and surgical history, insurance status, smoking history,*alcohol history, ABO compatibility

Absence of previous major abdominal surgery

Absence of major medical problems (eg, diabetes mellitus, uncontrolled hypertension, hepatic disease, cardiac disease, renal dysfunction, pulmonary disease)

II.

Evaluation by hepatologist, social worker, medical psychologist, and coordinator, including: Complete medical history and physical examination

Laboratory tests: complete blood count, electrolytes, liver function tests, confirm ABO type, cytomegalovirus antibody (IgG and IgM), rapid plasmin reagin, antinuclear antibody, human immunodeficiency virus antibody, hepatitis B virus surface antigen, hepatitis B virus core antibody, hepatitis C antibody, serum ferritin, iron, transferrin, and ceruloplasmin, α_1 -antitrypsin level, chest radiography, electrocardiography

III.

Surgical evaluation of donor

Preoperative anesthesia evaluation

IV.

Magnetic resonance imaging of liver, biliary system and hepatic vasculature

Other tests* to clarify any potential problems uncovered during evaluation process including but not limited to endoscopic retrograde cholangiopancreatography, hepatic arteriography, liver biopsy, stress echocardiogram, pulmonary function tests

V.

Presentation of data at transplant-listing conference

Final meeting with hepatologist or surgeon to again discuss surgery and its implications

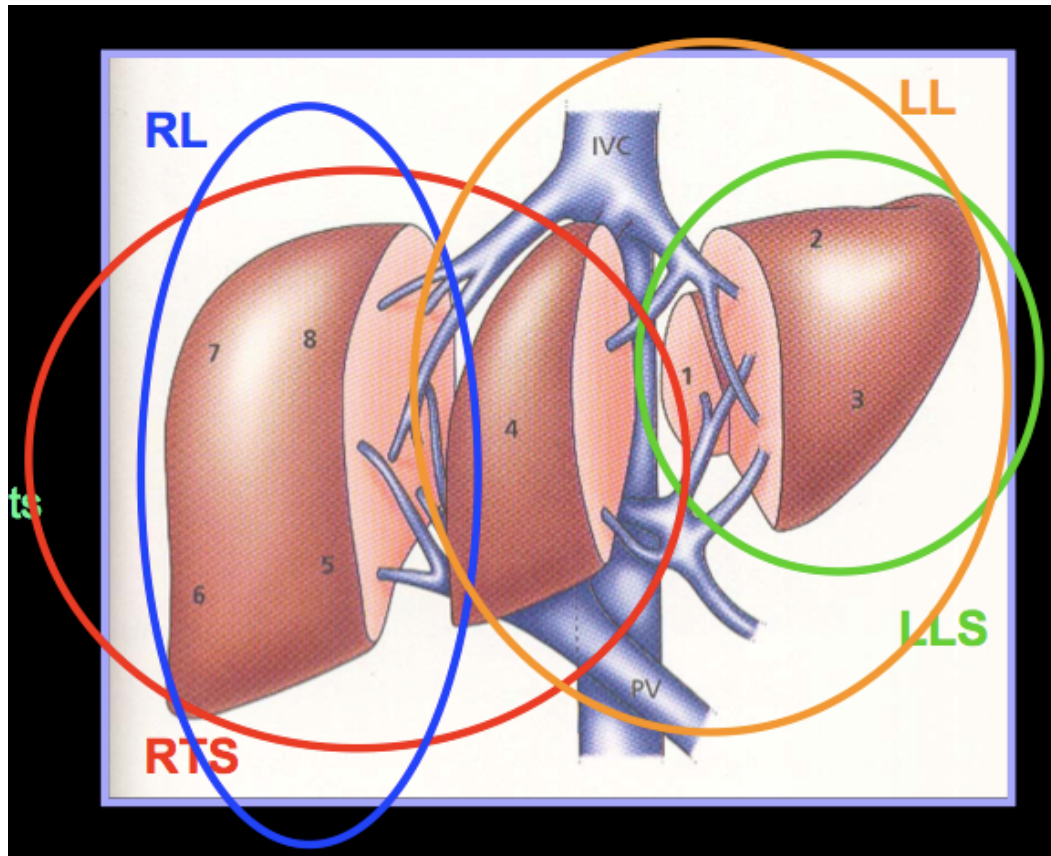
Informed consent obtained

Surgery scheduled

*Smokers are required to stop smoking for 1 month before surgery and undergo other pulmonary and cardiac testing as appropriate.

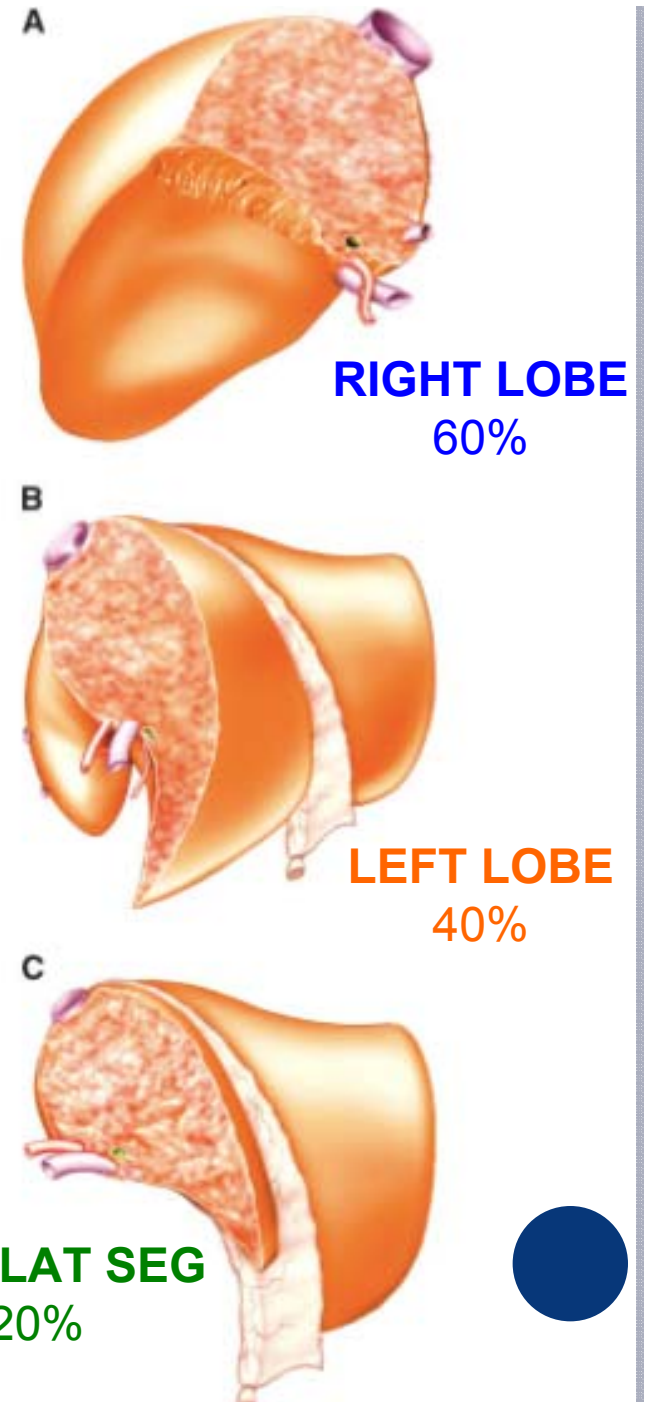


GRAFTS



Couinaud – 8 segments – 1957

Liver Mass ~ 1500g
 Right Lobe ~ 1000g
 Left Lobe ~ 500g

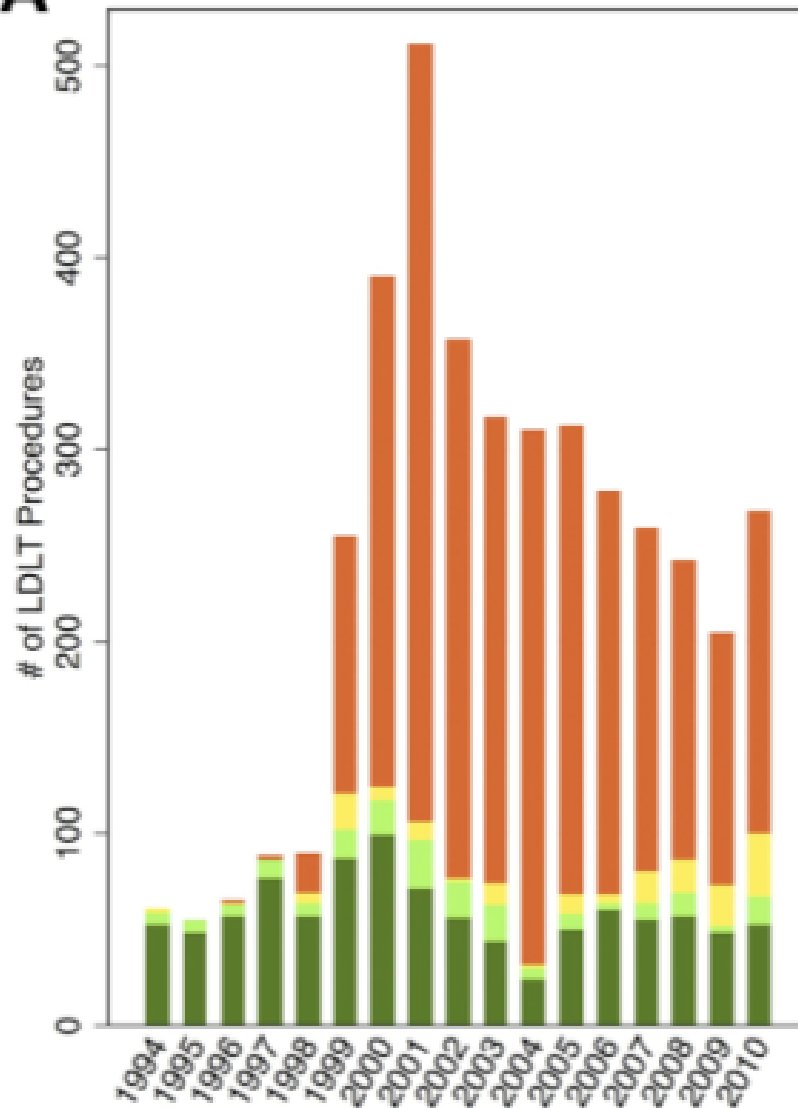


LEFT LAT SEG
 20%

[Olthoff Tx Hep Course 2008, Florman AASLD 2006]

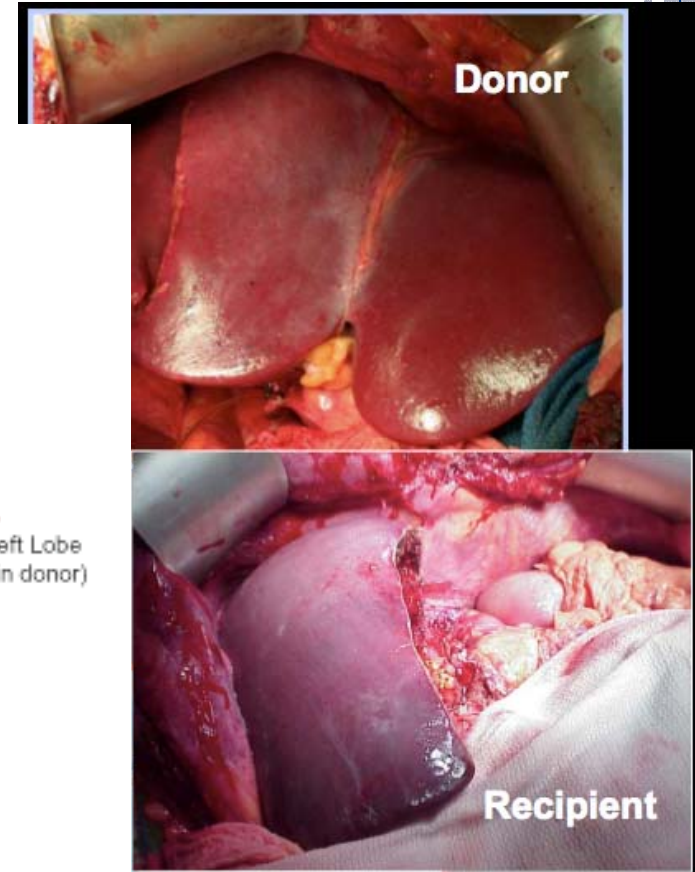
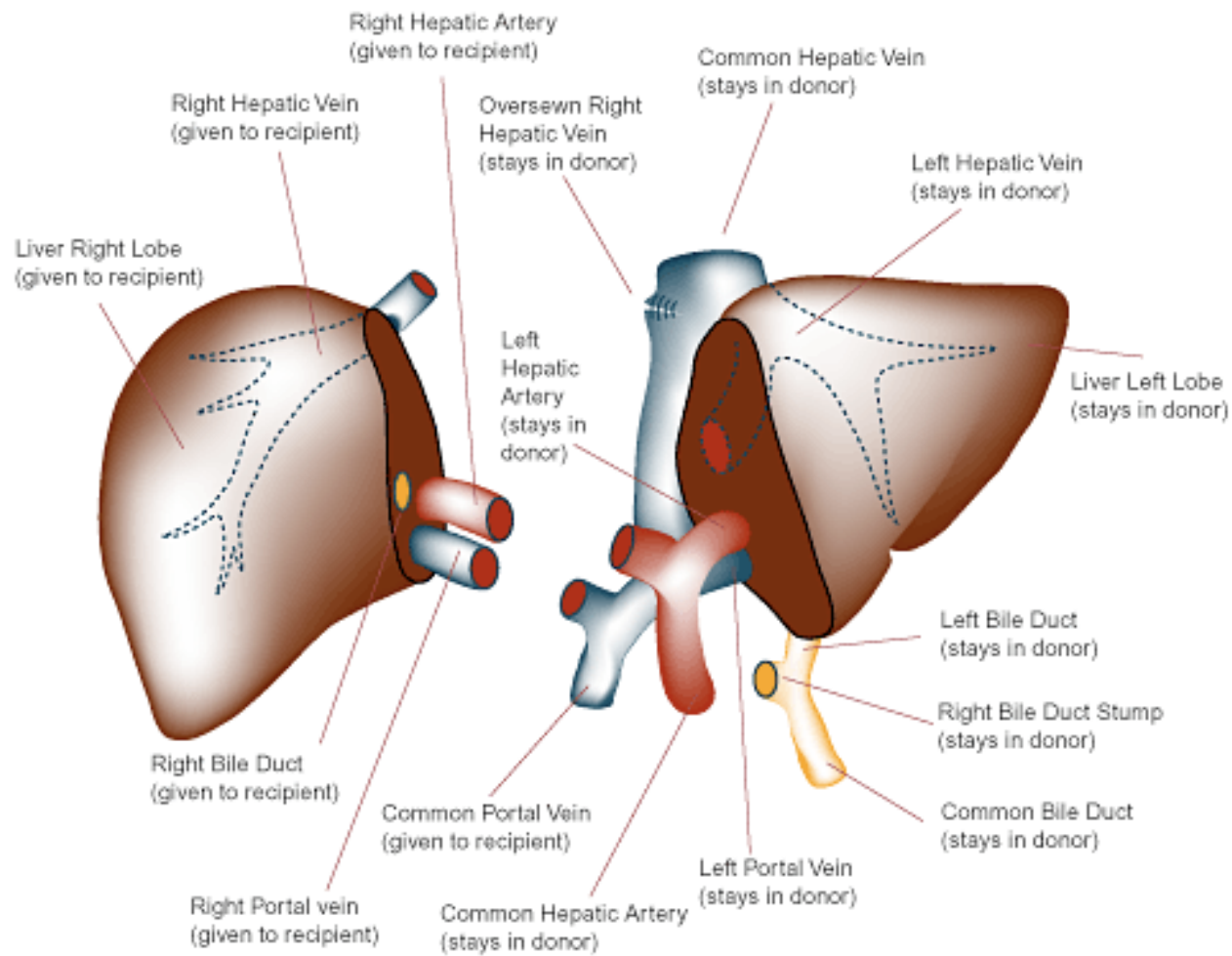
LDLT – GRAFT TYPE

A

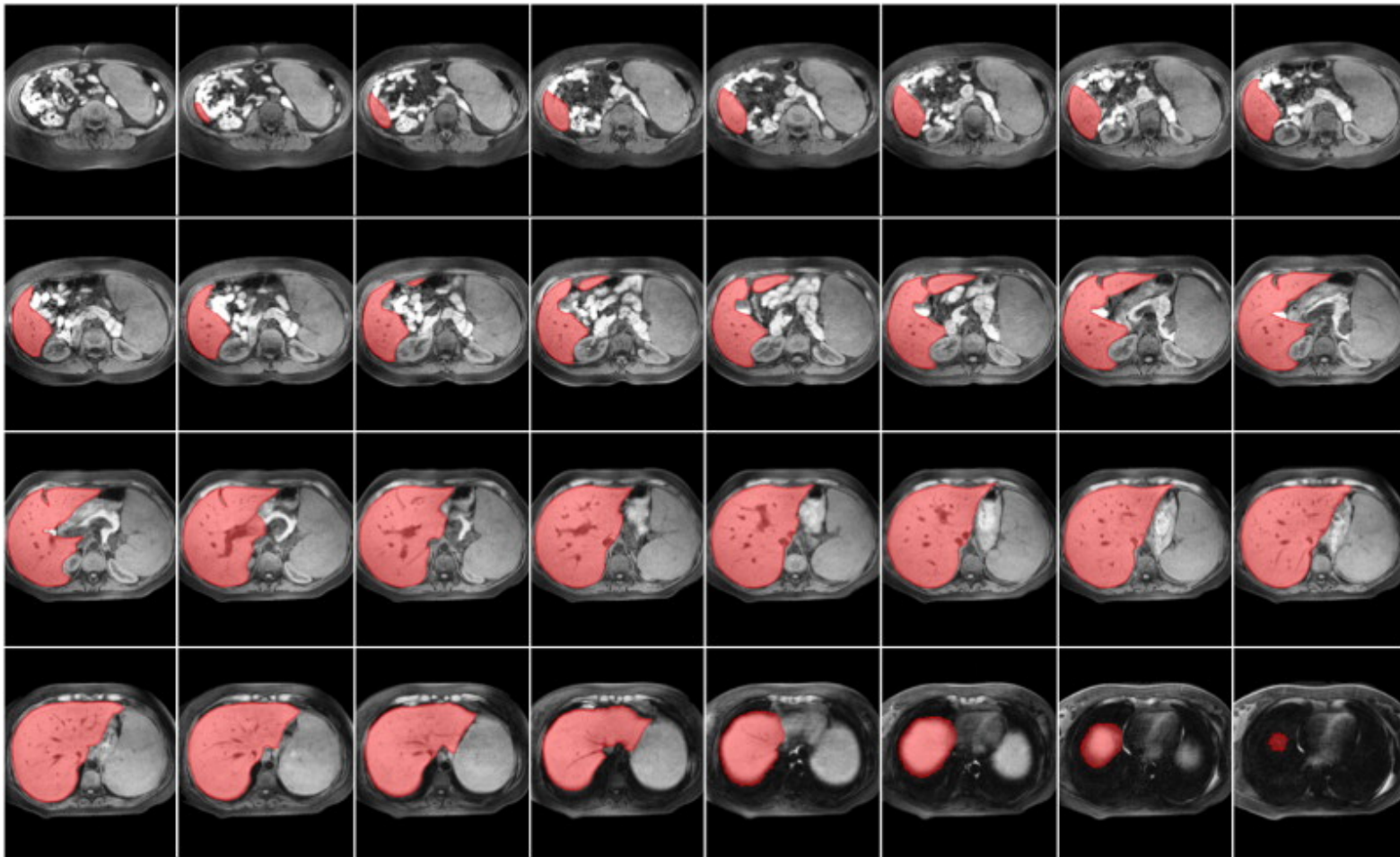


Orange: RL adult → adult
Green: LLS adult → child
Lime: LL adult → child
Yellow: LL adult → adult

GRAFTS – RIGHT LOBE



MRI LIVER - VOLUMETRICS



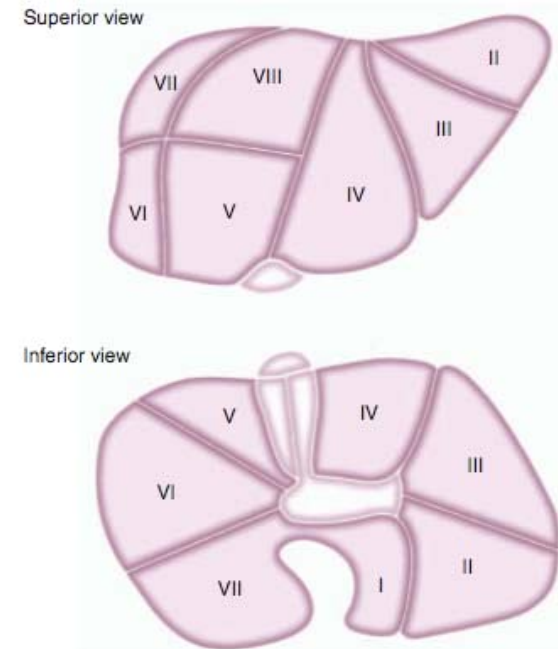
[Bracoud *Blood Cells, Mol and Dis* 2011]

SIZE MATTERS

	3-D Volume (cm ³)	Proportion to Total (%)
Total liver	1127 (759–1751)	
Left liver + caudate lobe	432* (253–700)	37 (25–48)
Left liver	398 (147–651)	34 (15–45)
Caudate lobe	43 (8–106)	3 (1–11)
Right liver	729* (434–1085)	63 (53–75)
Paramedian sector	438 (20–736)	39 (24–48)
Lateral sector	289* (129–496)	25 (14–43)
Territory of V5	135* (18–395)	11 (2–27)
Territory of V8	84 (10–310)	8 (1–18)

Small for Size Syndrome (SFSS)

- Primary Graft Dysfunction
 - Intracellular cholestasis
 - Coagulopathy
 - Portal HTN
 - Ascites
- Evident in first week
- Graft to Recipient Body Weight Ratio < 0.8 - 1
- Size not only factor, degree of steatosis and regeneration factors can affect



PROMETHEUS



[Internet Pix]

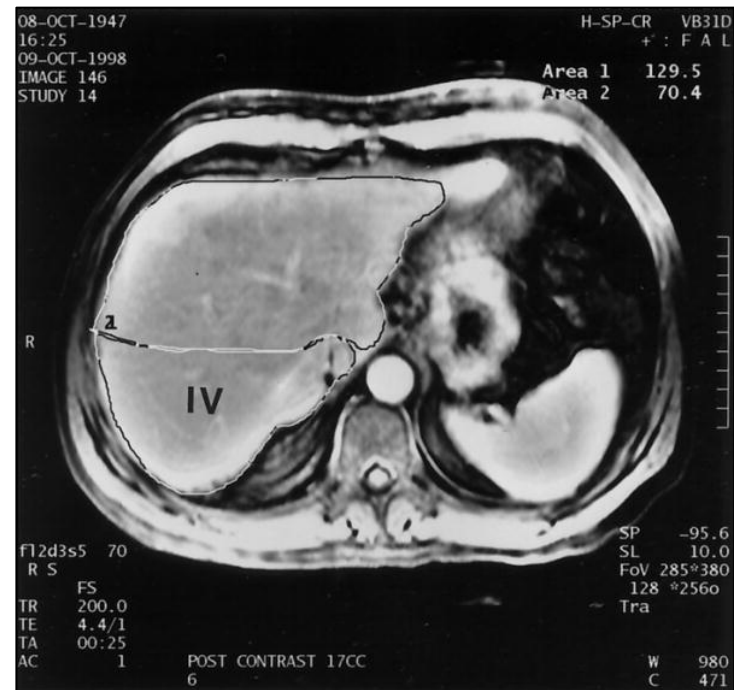
RATS

- “Restoration of the Liver of the White Rat Following Partial Surgical Removal.” 1931
 - Removed 70% of liver volume
 - Post-op day 2: liver 45% of original
 - Post-op day 3: liver was 70% of original
 - Post-op day 14: original size +/- 10%
- The lobes removed do not grow back
- Remnant lobes expand to original liver weight



DOES THIS OCCUR IN HUMANS?

- Donor Liver – 7 days after R hepatectomy



*disclaimer: this is a representation,
not the same pt



LIVER REGENERATION AND FUNCTION IN DONOR AND RECIPIENT AFTER RIGHT LOBE ADULT TO ADULT LIVING DONOR LIVER TRANSPLANTATION¹².

Marcos, Amadeo; Fisher, Robert; Ham, John; Shiffman, Mitchell; Sanyal, Arun; Luketic, Velimir; Sterling, Richard; Fulcher, Ann; Posner, Marc

Transplantation. 69(7):1375-1379, April 15, 2000.

Initial mass	Donor Postoperative day			
	7	14	30	60
598 (±137)	1202 (±171)	1256 (±156)	1238 9 (±128)	1458 (±104)

Initial mass	Recipient Postoperative day			
	7	14	30	60
862 ^a (±154)	1614 (±184)	1738 (±254)	1889 (±149)	1721 (±134)

~1998-1999
 ~VCU/MCV
 ~31 LDLT
 ~R lobectomy
 ~GRBW 1%, 0.8%
 ~Adjustment made for steatosis
 ~MRI analysis

Other studies:

After 60% liver removed, at 3 months donors had 76% of original volume and recipients 104%. Remodeling process likely continues up to a year. Somewhat slower in women.

LIVER REGENERATION

Table 1. Main Cytokines, Growth Factors, and Transcription Factors Involved in Liver Regeneration

Cytokines

Tumor necrosis factor

Tumor necrosis factor receptor 1

Interleukin-6

Growth factors

Transforming growth factor- α

Hepatocyte growth factor

Epidermal growth factor

Heparin-binding epidermal growth factor

Keratinocyte growth factor

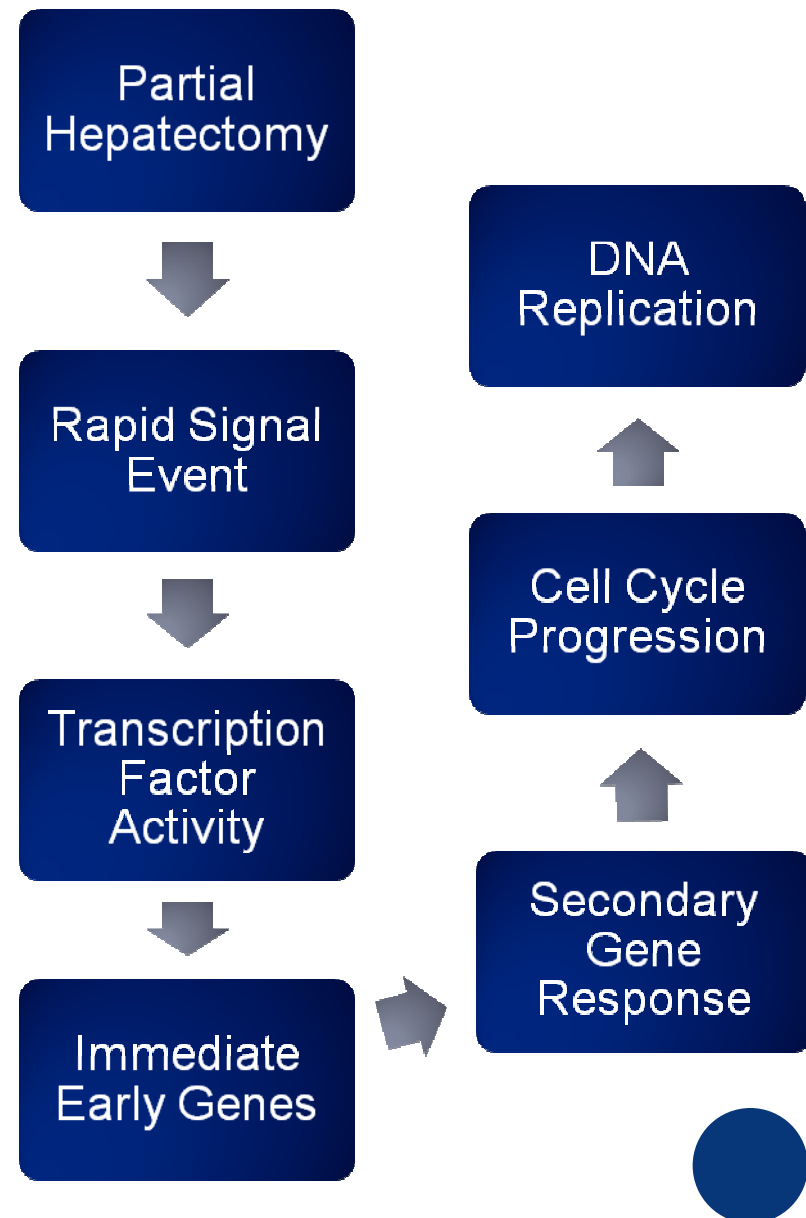
Transcription factors

Nuclear factor- κ B

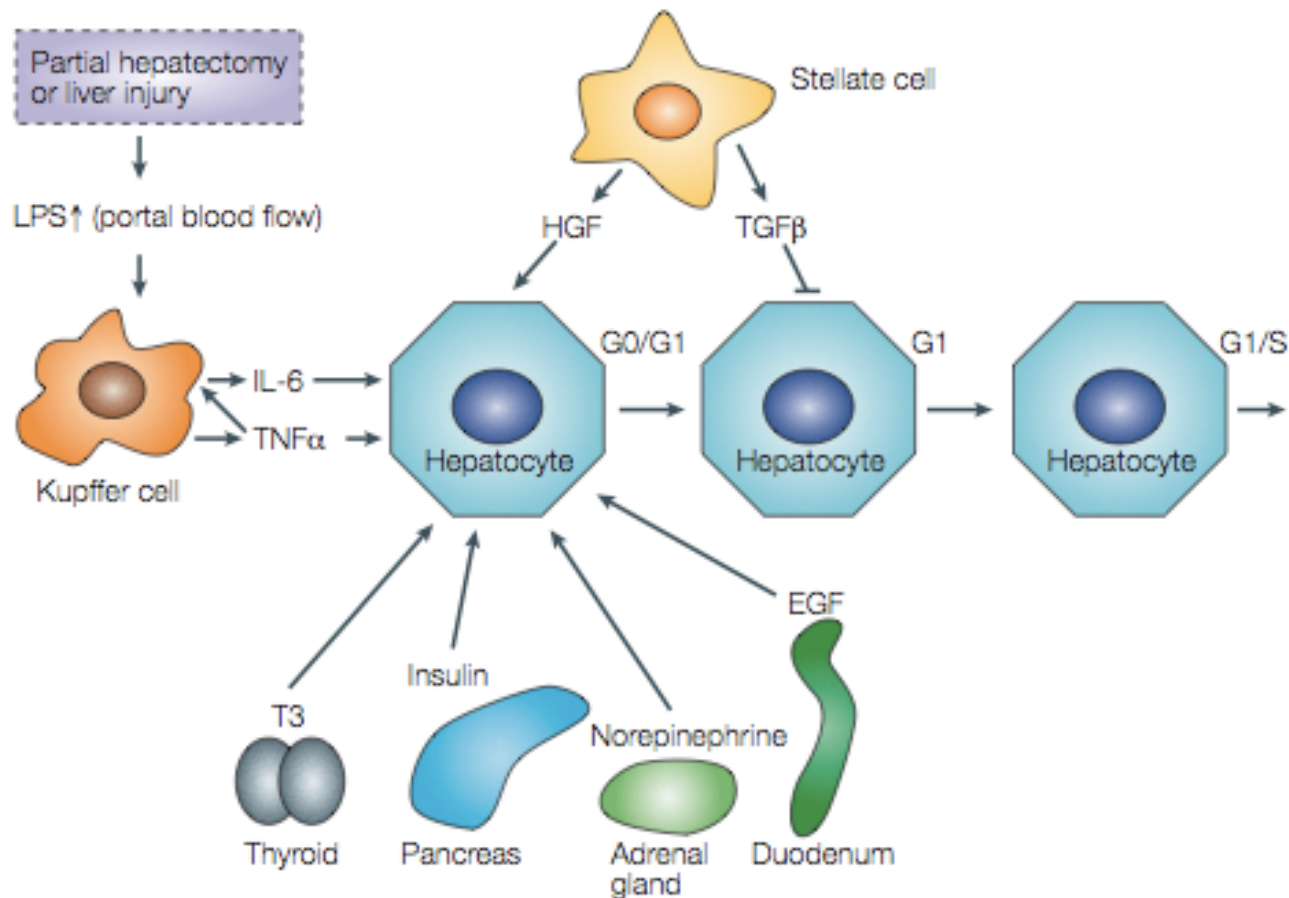
Signal transducer and activator of transcription 3

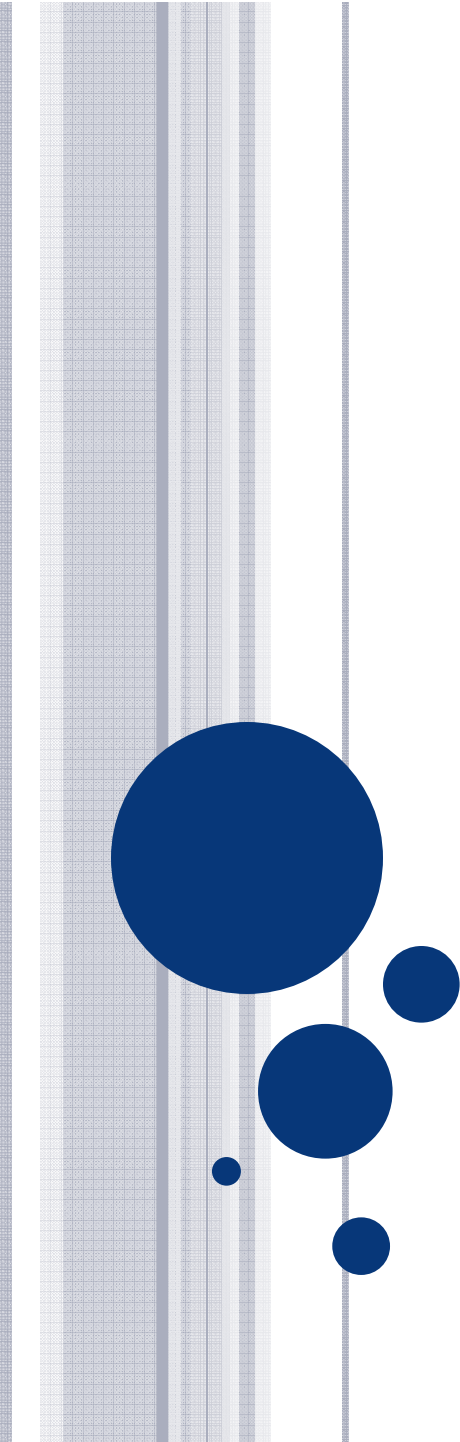
Activating protein-1

CAAT enhancer binding protein β (C/EBP β)



REGENERATION - PATHOGENESIS





**IS IT SAFE
TO DONATE?**

DONOR MORTALITY

- Infrequent, but devastating complication
- Mt Sinai 2002 – donor died 3 days after donating to his brother

Death at Mount Sinai

By SUSAN SAULNY

To the Editor: "Every Patient's Nightmare" (editorial, March 14) is correct in stating that Mike Hurewitz, who died after donating part of his liver, was entitled to better care at Mount Sinai. We are reviewing staffing and response procedures and moving forward with a strong corrective action plan that we have developed with the input of independent experts and will provide to the State Department of Health.

March 20, 2002 | OPINION | LETTER

MORE ON MIKE HUREWITZ AND: LIVER, TRANSPLANTS, CASE, NATHAN K, MOUNT SINAI MEDICAL CENTER, NEW YORK CITY

Liver Donors Face Perils Known And Unknown

By DENISE GRADY

When Laurie Post's family took her to an emergency room in Somerset, N.J., in September 2000, her temperature was 104.7. She was weak, anemic, vomiting and short of breath. Her abdomen was swollen and painful. Trim to begin with, she had lost 15 pounds. Her kidney function was poor. Seven weeks earlier, at the New York University Medical Center, Ms. Post had been a living organ donor, allowing 60 percent of her liver to be removed to provide a transplant for her cousin. The cousin had recover...

March 19, 2002 | SCIENCE | NEWS

MORE ON MIKE HUREWITZ AND: LIVER, TRANSPLANTS, SURGERY AND SURGEONS, NOVELLO, ANTONIA, MOUNT SINAI MEDICAL CENTER, NEW YORK CITY

Every Patient's Nightmare

By DENISE GRADY

You would think that Mike Hurewitz could have expected the best possible medical care in January when he donated more than half of his liver to save his brother's life. The operation was performed at one of New York City's best hospitals, Mount Sinai, which is a world leader in using live donors for liver transplants. There was risk, of course. Some experts say the odds of death for a liver donor can be as high as 1 in 100. But Mr. Hurewitz was healthy, and he was in the hands of a renowned live...

March 14, 2002 | HEALTH | EDITORIAL

MORE ON MIKE HUREWITZ AND: NURSING AND NURSES, LIVER, TRANSPLANTS, EDITORIALS, MALPRACTICE, DOCTORS, HOSPITALS, SURGERY AND SURGEONS, MOUNT SINAI NYU MEDICAL CENTER AND HEALTH SYSTEM, NEW YORK CITY



Documented Deaths of Hepatic Lobe Donors for Living Donor Liver Transplantation

James F. Trotter,¹ Rene Adam,² Chung Mau Lo,³ and Jeremy Kenison¹

¹University of Colorado Health Sciences Center, Denver, CO, ²Hepatobiliary Center, Paul Brousse Hospital, Villejuif, France, and ³Department of Surgery, Centre for the Study of Liver Disease, University of Hong Kong, Pokfulam, Hong Kong, China

- PubMed and Internet Search
 - 1989 – 2006, 4598 Transplants
 - 19 Donor deaths and 1 in Chronic Vegetative State
 - 13 “definitely” associated
 - 2 “possibly” related
 - 4 “unlikely” related
 - Estimated donor death rate = 0.2%
 - Asia and US did not have on-going mandatory reporting in place, Europe data more complete
 - Death at Lahey in 2010
- 

Hepatic Failure
Infection
Sepsis
SAH
PE
Pancreatitis
Ruptured PUD
MI
Unknown

Drug OD
Suicide

TABLE 1. Deaths of Living Donors

Reference	Date	Location	Description
Donor deaths "definitely" related to donor hepatectomy			
11	2003	Japan	A mother in her late 40s donated a right lobe and died 9 months later from complications of hepatic failure.
12	2002	USA	A 57-year-old brother donated a right lobe and developed gastric gas gangrene and <i>Clostridium perfringens</i> infection 3 days after surgery and died.
13	2005	Brazil	A 31-year-old female right lobe donor of unknown relationship to the recipient died 7 days after surgery from a subarachnoid hemorrhage.
14	2003	India	A donor of unknown age and unknown relationship to the recipient donated an unknown lobe and died 10 days after surgery of unknown causes.
15	2003	India	A 52-year-old wife donated an unknown lobe and became comatose 48 hours after surgery from unknown causes and remains in chronic vegetative state.
16-18	1993	Germany	A 29-year-old mother donated a left lateral lobe and died of a pulmonary embolus 48 hours after surgery.
18, 19	2000	Germany	A 38-year-old father donated a right lobe, and 32 days after developing progressive hepatic failure, died during transplantation of acute cardiac failure. The cause of the donor's death was attributed to Berardinelli-Selp syndrome, a lipodystrophy syndrome characterized by loss of body fat, diabetes, hepatomegaly, and acanthosis nigricans.
18, 20	2000	France	A 32-year-old brother donated a right lobe and developed sepsis and multiple organ system failure 11 days after surgery and died of septic shock 3 days later.
18	2000	Europe	A 57-year-old wife donated a right lobe and died of sepsis and multiple organ system failure 21 days after surgery.
21, 22	1999	USA	A 41-year-old half-brother donated a right lobe and died of pancreatitis and sepsis 1 month later.
22, 23	1997	USA	A mother of unknown age donated an unknown lobe to a pediatric recipient and died 3 days after surgery of unknown causes.
24	2005	Asia	A 50-year-old mother donated a right hepatic lobe. She had no history of peptic ulcer disease and received a 2-week course of H2 antagonist. She died 10 weeks after surgery from an autopsy-proven duodenal ulcer with a duodenocaval fistula causing air embolism.
25	2006	Asia	A 39-year-old male "close relative" who donated an unknown lobe died of a myocardial infarction 4 days after donation. The patient reportedly had a preoperative electrocardiogram and treadmill test.
26	2005	Egypt	A brother of unknown age who donated a right lobe died of complications of sepsis from a bile leak 1 month after donation.
Donor deaths "possibly" related to donor hepatectomy			
27	2005	USA	A 35-year-old brother donated a right lobe and died of a self-induced drug overdose 23 months later.
27	2005	USA	A 50-year-old uncle donated a right lobe and died of a self-inflicted gunshot wound to the head 22 months after donation.
Donor deaths "unlikely" to be related to donor hepatectomy			
28	2003	Asia	A donor of unknown age and relationship to the recipient who donated an unknown lobe died of unknown causes during exercise 3 years after donation.
27, 29	2002	USA	A 35-year-old boyfriend donated a right lobe and died in a nonsuicidal occupational pedestrian-train accident 2 years after donation. A lone railroad car rolling at high speed struck and killed the donor while he was on duty at his job for the railroad.
16	2003	Germany	A 30-year-old father donated a left lateral segment and died of complications of amyotrophic lateral sclerosis 11 years after successful donation.
30	2003	Japan	A male donor in his 40s of unknown relationship to the recipient donated an unknown lobe died 10 years postoperatively after an apparently unrelated surgery.

Estimates of Early Death, Acute Liver Failure, and Long-term Mortality Among Live Liver Donors

ABIMEREKI D. MUZAALE,^{*,‡} NABIL N. DAGHER,^{*} ROBERT A. MONTGOMERY,^{*} SARAH E. TARANTO,[§]
MAUREEN A. MCBRIDE,[§] and DORRY L. SEGEV^{*,‡}

^{}Department of Surgery, Johns Hopkins University School of Medicine, Baltimore, Maryland; [‡]Department of Epidemiology, Johns Hopkins School of Public Health, Baltimore, Maryland; and [§]United Network for Organ Sharing, Richmond, Virginia*

- United States Data
 - 1994 – 2011
 - 4111 Living Liver Donors
 - Pediatric and Adult Recipients
 - 7 Early Deaths
 - 1.6-1.7 per 1000 cases
 - 11 Catastrophic Events
 - 2.9 per 1000 cases
 - Risk of death did not vary with portion of liver donated
 - 67% RL, 24% LLS, 9% LL



EARLY DEATH AND LIVER FAILURE

- Cause of early death (within 90 days post-op)

- Anaphylaxis
- MSOF
- Infection
- Overdose (infant recip)
- Suicide
- CV
- Resp arrest

Outcomes of the 5 pts with Liver Failure	
Wait-list diagnosis	Final outcome
Multi-organ failure ^b	Died
Subfulminant failure	Improved ^c
Budd–Chiari syndrome ^{d,e}	DDLT
Acute liver failure ^f	DDLT
Budd–Chiari syndrome	DDLT
All of these were R Lobe Donors	

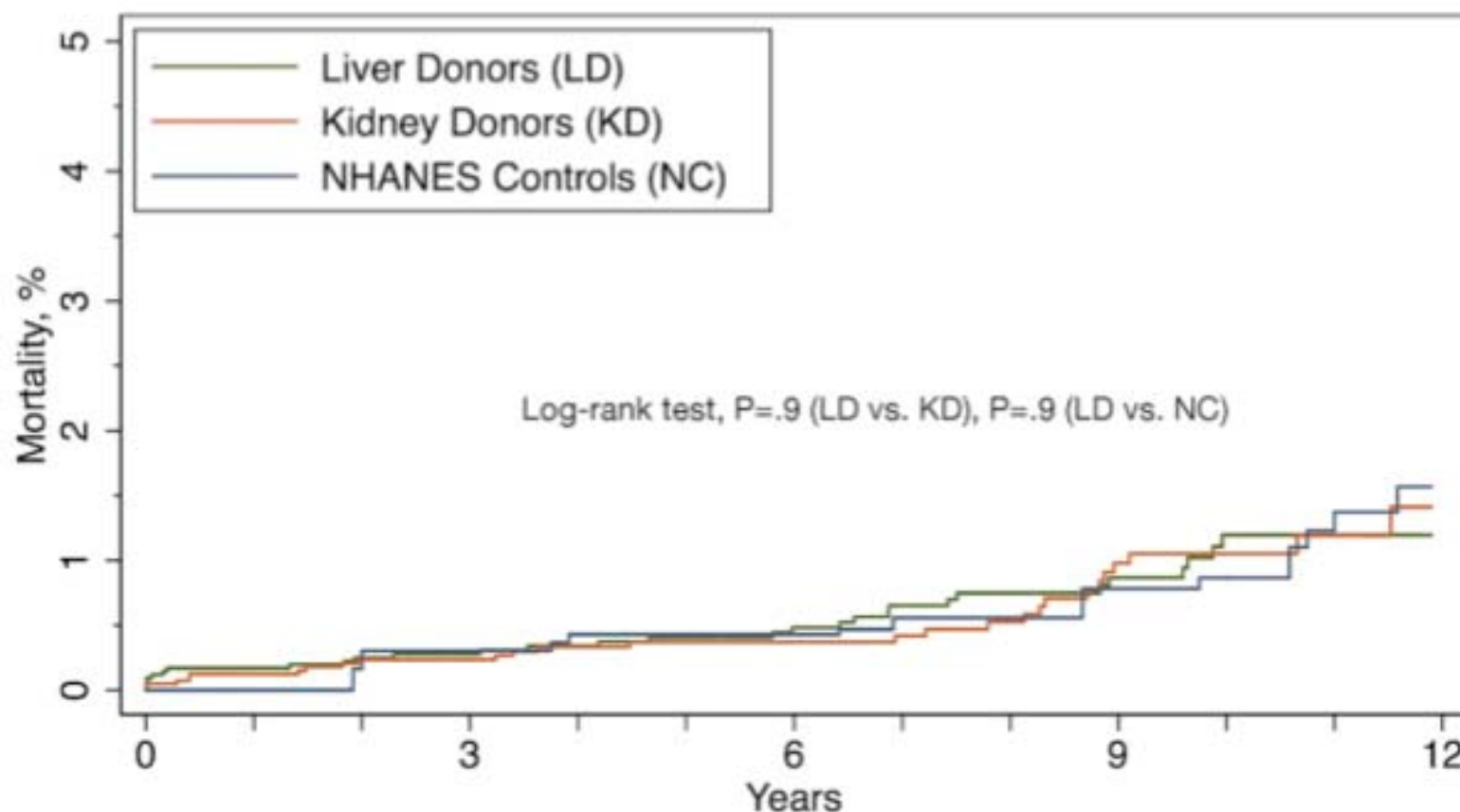
- Catastrophic Events

- 7 Early Deaths
- 3 ALF – all transplanted
- 1 Subacute Liver Failure - improved



LONG-TERM DONOR MORTALITY

- Comparable to that of Kidney Donors and NHANES Controls over 11 years



A2ALL STUDY GROUP



- Living Donor Liver Transplant Cohort Study
- Multi-year



U. S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
National Institutes of Health



Columbia University Health Sciences



NORTHWESTERN
UNIVERSITY



UCSF Medical Center



University of Pittsburgh



UNIVERSITY OF TORONTO
FACULTY OF MEDICINE



VCU Health System
Virginia Commonwealth University

Donor Morbidity After Living Donation for Liver Transplantation

RAFIK M. GHOBRIAL,* CHRIS E. FREISE,[†] JAMES F. TROTTER,[§] LAN TONG,^{||} AKINLOLU O. OJO,[¶] JEFFREY H. FAIR,[#] ROBERT A. FISHER,** JEAN C. EMOND,^{††} ALAN J. KOFFRON,^{§§} TIMOTHY L. PRUETT,^{|||} KIM M. OLTHOFF,^{¶¶} and the A2ALL Study Group

- 1998 – 2003 A2ALL
- 393 Donations

Table 3. Intraoperative and Postoperative Characteristics of Donors

Characteristic	N	Range	Mean (SD) or percent
Remnant liver weight (g) ^a	388	180–1152	582 (156)
≥ 180 to ≤ 480	98		25
> 480 to ≤ 582	99		25
> 582 to ≤ 681	95		24
> 681 to ≤ 1152	96		24
Units of transfused blood	387	0–4	0.4 (0.8)
0	267		68
> 0 to ≤ 1	84		21
> 1 to ≤ 2	26		7
> 2 to ≤ 3	6		2
> 3 to ≤ 4	4		1
Hypotension (< 100 mm Hg systolic)			
Yes	88		22
No	288		73
Missing	17		4
Operative time (min)	329	236–930	458 (133)
≥ 236 to ≤ 358	83		25
> 358 to ≤ 424	82		25
> 424 to ≤ 557	82		25
> 557 to ≤ 930	82		25

Table 2. Characteristics of Accepted Adult Living Liver Donors

Characteristic	N	Range	Mean (SD) or percent
Age, y	404	18–59	37 (9.6)
Sex			
Female	182		45
Male	223		55
Ethnicity			
Hispanic/Latino	68		17
Non-Hispanic/non-Latino	335		83
Missing	2		1
Race			
White	366		90
African American	15		4
Asian	13		3
Other	9		2
Missing	2		1
Height (cm)	397	150–203	173 (10.0)
Weight (kg)	402	43–141	78 (15.0)
Body mass index (kg/m ²)	397	17–43	26 (3.9)
< 20	19		5
≥ 20 to < 25	136		34
≥ 25 to < 30	182		45
≥ 30	60		15
Missing	8		2
Relatedness to recipient			
Biologically related			
Parent	9		2
Child	139		34
Sibling	92		23
Other biological	35		9
Not biologically related			
Spouse	51		13
Other nonbiological	78		19
Unknown/missing	1		< 1

Donor Morbidity After Living Donation for Liver Transplantation

RAFIK M. GHOBRIAL,* CHRIS E. FREISE,⁺ JAMES F. TROTTER,^{\$} LAN TONG,^{||} AKINLOLU O. OJO,[¶] JEFFREY H. FAIR,[#] ROBERT A. FISHER,^{**} JEAN C. EMOND,⁺⁺ ALAN J. KOFFRON,^{\$\$} TIMOTHY L. PRUETT,^{|||} KIM M. OLTHOFF,^{¶¶} and the A2ALL Study Group

Table 4. Initial and Subsequent Hospitalizations of Donors

	N	Range	Mean (SD) or percent
Initial donor hospitalization length of stay (<i>day</i>)	391	2–28	7.0 (2.7)
≥ 2 to < 6	98		25
≥ 6 to < 7	90		23
≥ 7 to < 8	91		23
≥ 8 to ≤ 28	112		28
No. of rehospitalizations			
0	342		87
1	37		9
2	8		2
3–5	6		2

Table 5. Type and Severity of Complications of Donors With Nonaborted Procedure According to Clavien Grade

Complication	No. donors	Percent donors	Grade 1	Grade 2	Grade 3	Grade 4
Intraoperative						
Intraoperative injury ^a	4	1.0				
Intraoperative other complications ^a	6	1.5				
Biliary						
Bile leak ^b /biloma	36	9.2	13	22	1	
Biliary stricture ^c	2	0.5	1	1		
Abdominal						
Intraabdominal bleeding	4	1.0	2	2		
Upper/lower GI bleeding	2	0.5	2			
Intraabdominal abscesses	9	2.3	2	6	1	
Ileus	8	2.0	7	1		
Bowel obstruction	5	1.3	3	2		
Incisional hernia	22	5.6	2	16	4	
Wound dehiscence	1	0.3		1		
Unplanned reexploration	12	3.1	1	11		
Complications during surgical reexploration ^a	2	0.5				
Cardiopulmonary						
Pneumothorax	3	0.8	2	1		
Pleural effusion	21	5.3	18	3		
Pulmonary edema	5	1.3	4	1		
Aspiration	1	0.3	1			
Pulmonary embolism	2	0.5	2			
Hepatic						
Ascites	3	0.8	3			
Liver failure	0	0.0				
Hepatic artery thrombosis	0	0.0				
Portal vein thrombosis	2	0.5	1	1		
Inferior vena cava thrombosis	1	0.3		1		
Other						
Deep vein thrombosis	0	0.0				
Neuropaxia	16	4.1	12	2	2	
Infections (donors may have more than 1 infection)	49	12.5	18	30		1
Bacterial ^a	49	12.5				
Viral ^a	2	0.5				
Fungal ^a	1	0.3				
Psychologic difficulties	16	4.1	12	2		2
Total			106	103	8	3

NUMBER OF DONOR COMPLICATIONS

# of Complications	# of Donors	% of Donors
None	243	62.1%
Any	148	37.9%
One	82	21%
Two	40	10.2%
Three	16	4.1%
Four - Seven	10	2.6%



Spleen Volume and Platelet Count Changes among Donors after Living Donor Liver Transplantation

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- 10-year study (1994-2004), Taiwan
- 180 donors included
 - L hepatectomy – 102
 - R hepatectomy – 78
- Spleen volume (SV) measured using CT pre-op and 6 months later



DONOR CHANGES

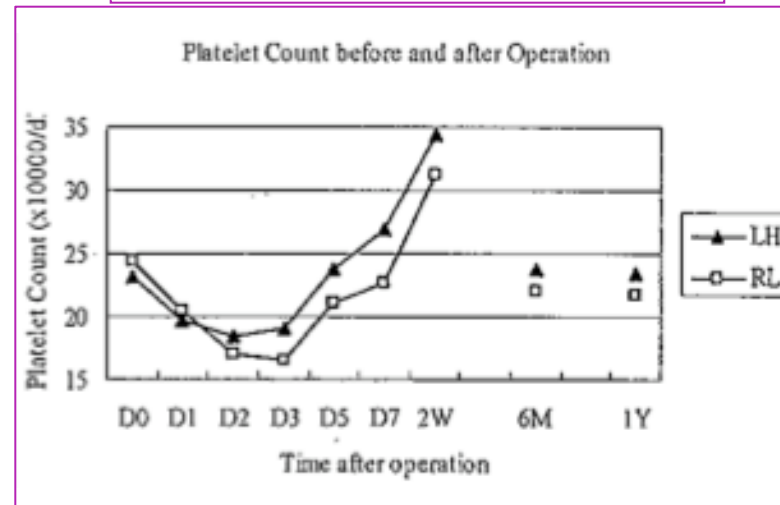
SPLEEN VOLUME

Group	S_0	S_{6m}
LH	152 ± 52	$175 \pm 61^*$
RL	164 ± 68	$237 \pm 101^*$

- ~Measured in cubic cm
- ~Increased in both groups, $R >> L$
- ~17 pts had a decrease in SV

- ~Other studies have shown similar, but extension to 1 year shows preoperative spleen size
- ~SV may increase due to increase in portal flow
- ~Splénomegaly does not reliably induce hypersplenism

PLATELET COUNT



- ~Decreased in both groups in first 3 post-op days
- ~Increased to above baseline day 3 to 5
- ~By 6 months, back to preoperative values

Laboratory Test Results After Living Liver Donation in the Adult-to-Adult Living Donor Liver Transplantation Cohort Study

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- 12 year study
- A2ALL Data
- 487 Living Donors
- Info collect on basic lab results
- Time points: evaluation, post-1 week, 1 month, 3 months, 12 months, yearly

TABLE 1. Characteristics of 487 Liver Transplant Donors at the Time of Evaluation

Characteristic	n	Mean (Standard Deviation) or %	Range
Age (years)	487	37.6 (10.2)	20-65.3
Sex			
Male	235	48%	
Female	252	52%	
Ethnicity			
Hispanic	75	15%	
Non-Hispanic	412	85%	
Race			
White	431	88%	
African American	14	3%	
Asian	9	2%	
Other	33	7%	
Height (cm)*	479	171.7 (10)	134.6-195.6
Weight (kg)*	478	77.1 (14.5)	43.1-135
Body mass index (kg/m ²)*	475	26.3 (3.9)	13.8-42.5

A2ALL LAB TEST RESULTS

- WBC, Hgb
- Ferritin
- BUN and Cr

Changes evident in first week.
All normalized to baseline by 1-2 years.

- AST
- AP
- TB
- INR
- Albumin

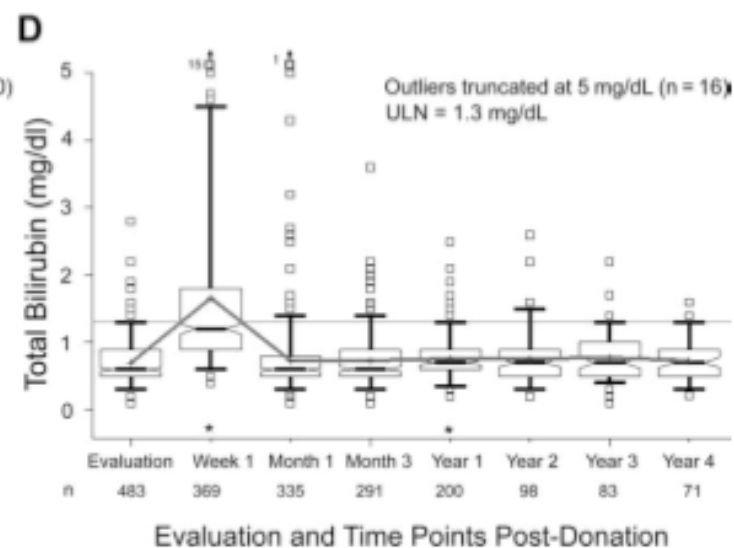
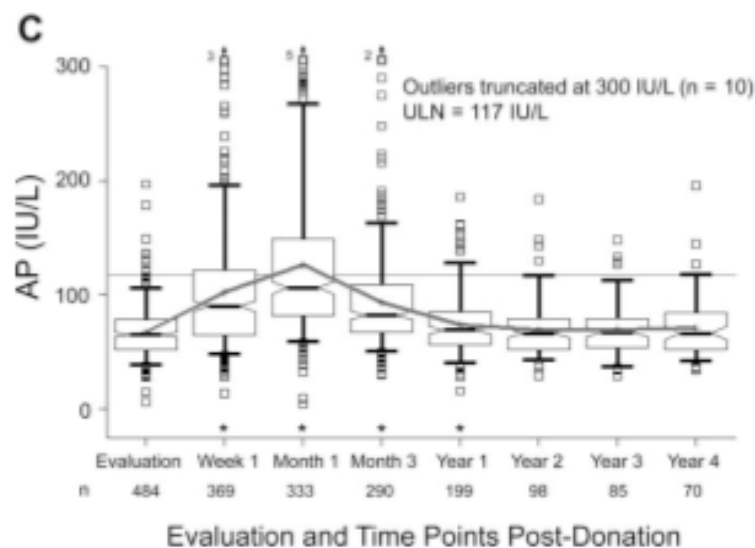
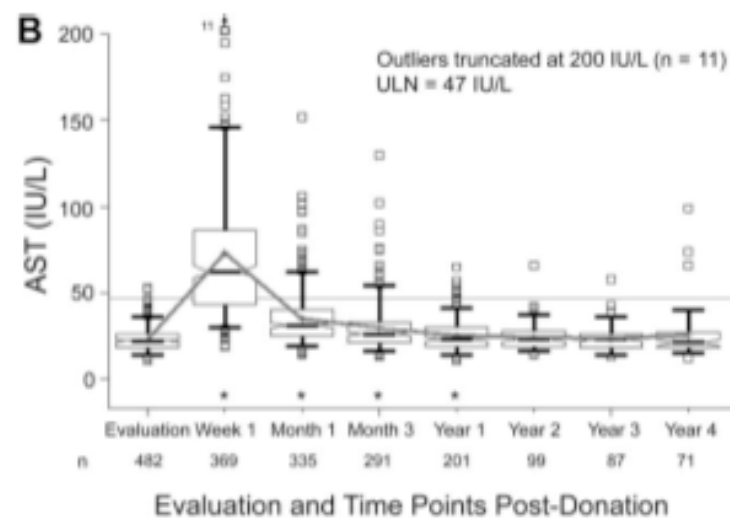
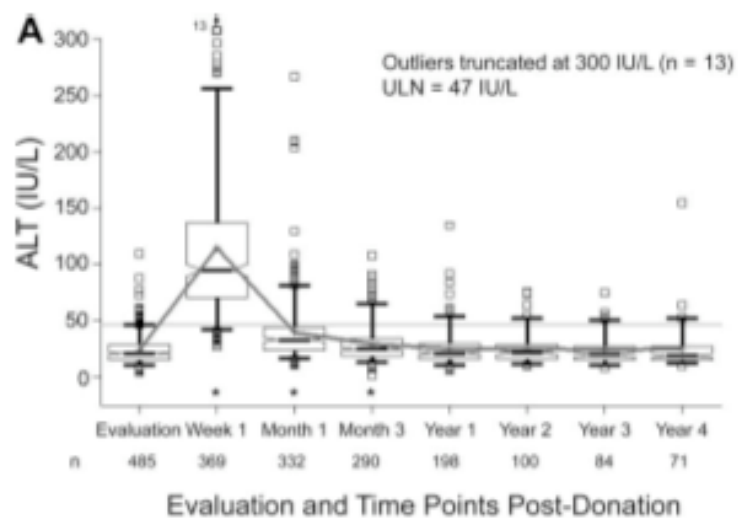
Up to 1 year, changed from baseline
(statistically significant), but WNL.
No significant change after 1 year.

- Platelets

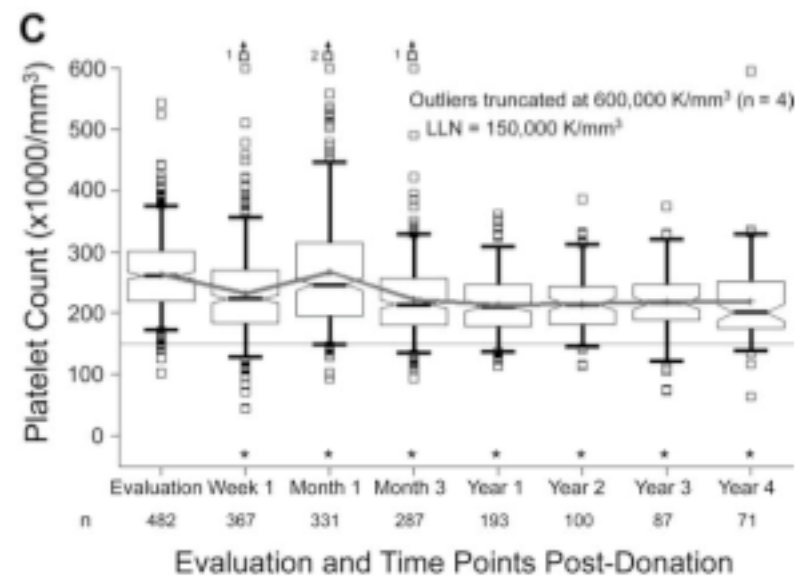
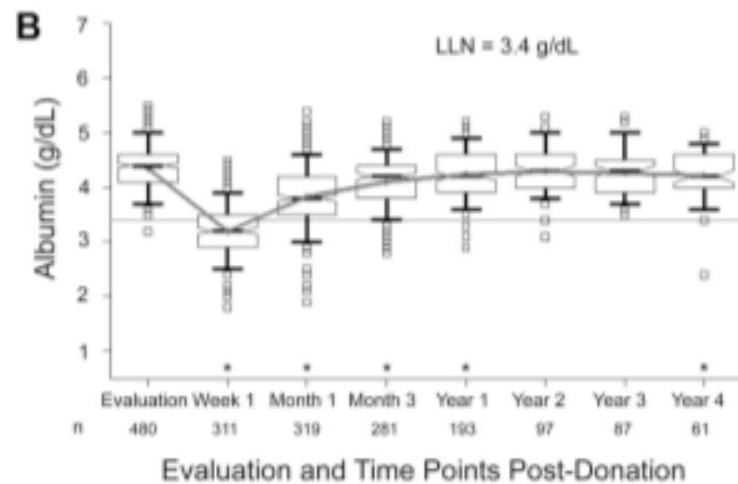
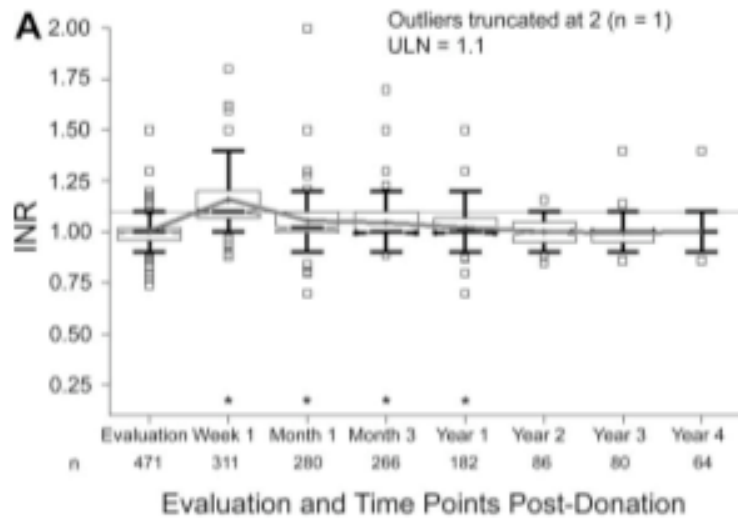
Significantly lower up to post-4 years,
but WNL.



A2ALL LAB TEST RESULTS



A2ALL LAB TEST RESULTS



THEORIES – WHY PLATELETS DROP

- Elevated portal pressure
 - Inadequate regeneration of hepatic remnant
 - Relative portal or hepatic venous insufficiency
 - Sinusoidal hyperperfusion
- Changes in thrombopoietin
 - Is the growth factor responsible for platelet production
 - Thrombopoietin is made in the liver
 - Other studies have shown it peaks 7 days post-donation
- Portal Vein Thrombus
 - Occurs in less than 1% of cases



DONOR BURDEN

- Donor guilt
 - Especially if recipient has poor outcome
- Financial burden
 - Loss of work
- Insurance implications

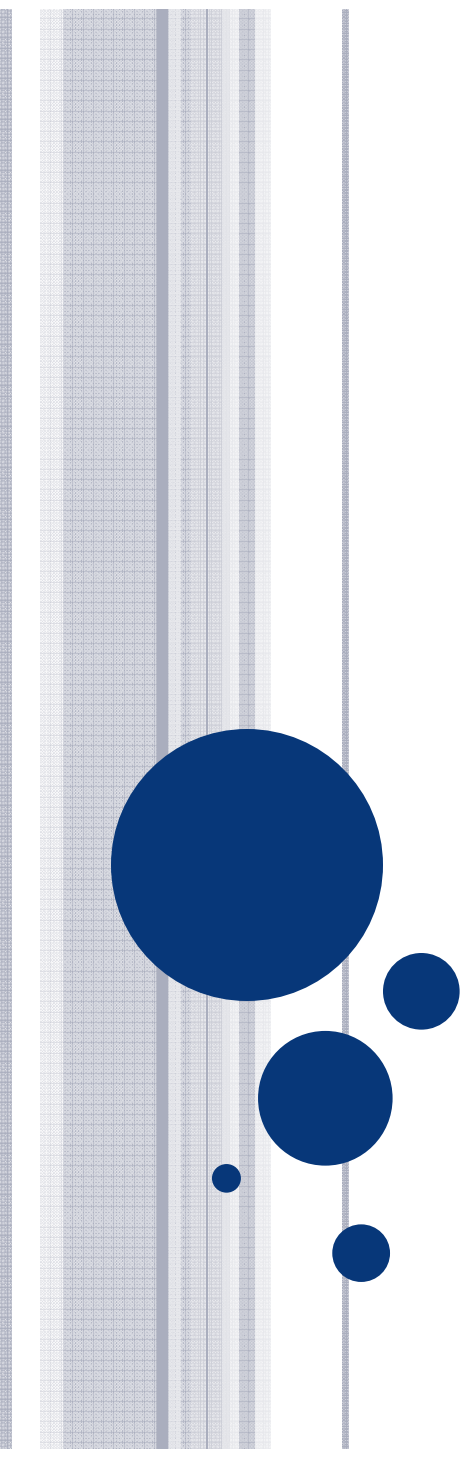


POP QUIZ

Q: What electrolyte abnormality do you have to watch for in the donor after PH?

A: HYPOPHOSPHATEMIA





RECIPIENT OUTCOMES

RECIPIENT SELECTION

- Age
- Degree of Portal HTN
- PV Thrombus
- Recipient Anatomy
- Size-Matching
- MELD, ideally less than 20



Improvement in Survival Associated With Adult-to-Adult Living Donor Liver Transplantation

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- A2ALL, 1998 – 2003
- Adults w/chronic liver disease with potential living donor
- Compared mortality to those who received DDLT or remained on-list
- Median f/u 4.4 years

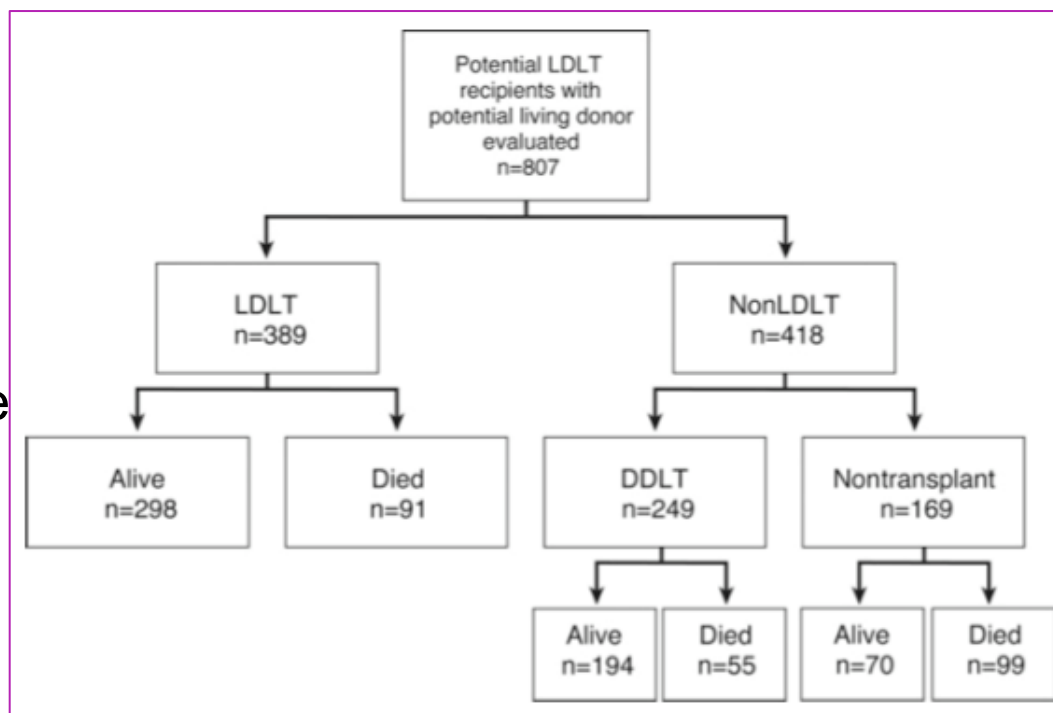
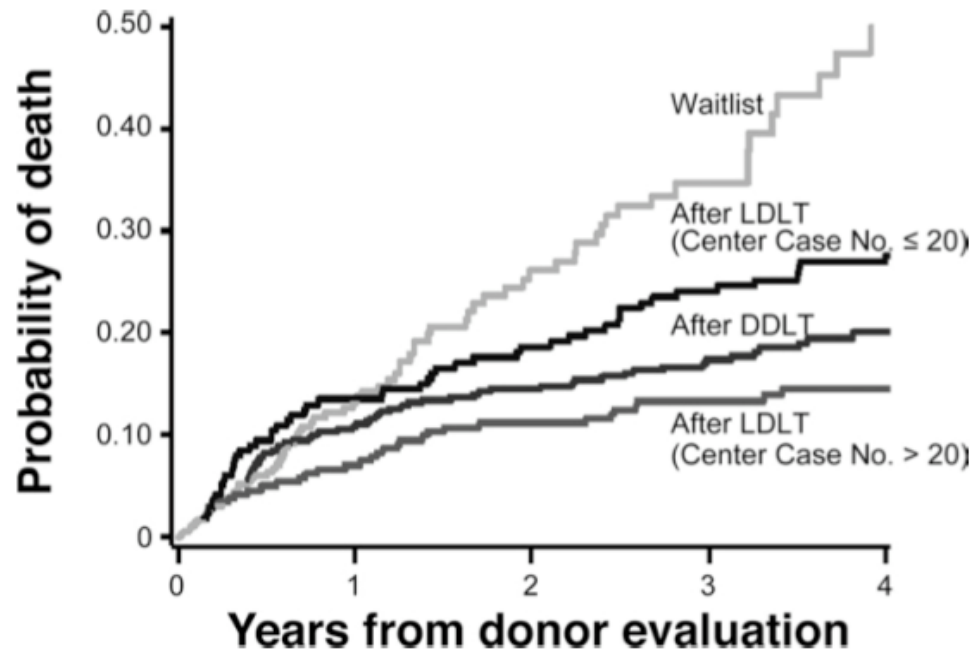


Table 1. Characteristics of Potential LDLT Recipients at Time of Donor Evaluation

Characteristic	Overall (n = 807) ^a Mean ± SD or percentage	LDLT (n = 389) Mean ± SD or percentage	Non-LDLT (n = 418) ^b Mean ± SD or percentage	LDLT vs Non-LDLT P value
Age (y)	50.3 ± 10.1	49.3 ± 10.7	51.3 ± 9.5	.006
Sex				.55
Male	57	58	56	
Female	43	42	44	
Race				.03
White	90	91	89	
African American	5	3	7	
Other	5	6	4	
Height (cm)	171.1 ± 10.3	171.4 ± 10.8	170.8 ± 9.8	.45
Weight (kg)	79.6 ± 18.0	78.6 ± 18.0	80.5 ± 18.0	.15
Body mass index (kg/m ²)	27.1 ± 5.2	26.7 ± 5.2	27.4 ± 5.2	.04
Previous transplant	2	3	1	.25
Diagnosis ^c				
Hepatitis C	47	48	47	.79
HCC	13	15	11	.10
Alcoholic liver disease	14	14	15	.62
Cholestatic liver disease	19	19	19	.97
Other noncholestatic cirrhosis	20	21	20	.87
Metabolic disease	3	3	3	.81
Biliary atresia	0.4	1	0	.11
Non-HCC malignancy	2	3	2	.29
Other	3	3	4	.31
Ascites	65	61	68	.01
Encephalopathy	48	40	55	<.001
Variceal bleed	18	17	19	.34
Upper abdominal surgery	20	20	19	.51
Spontaneous bacterial peritonitis	7	8	6	.27
TIPSS	11	8	12	.14
MELD	15.6 ± 6.8	14.8 ± 6.4	16.4 ± 7.2	.002

REDUCED MORTALITY COMPARED TO WAITING, ESPECIALLY AS CENTERS GAIN EXPERIENCE



Data adjusted for age, MELD, and HCC
This data is for a 50yo, **MELD 15**, and no HCC
8 centers with >20 , 1 with ≤ 20

EARLY RE-TX (<3 wks)

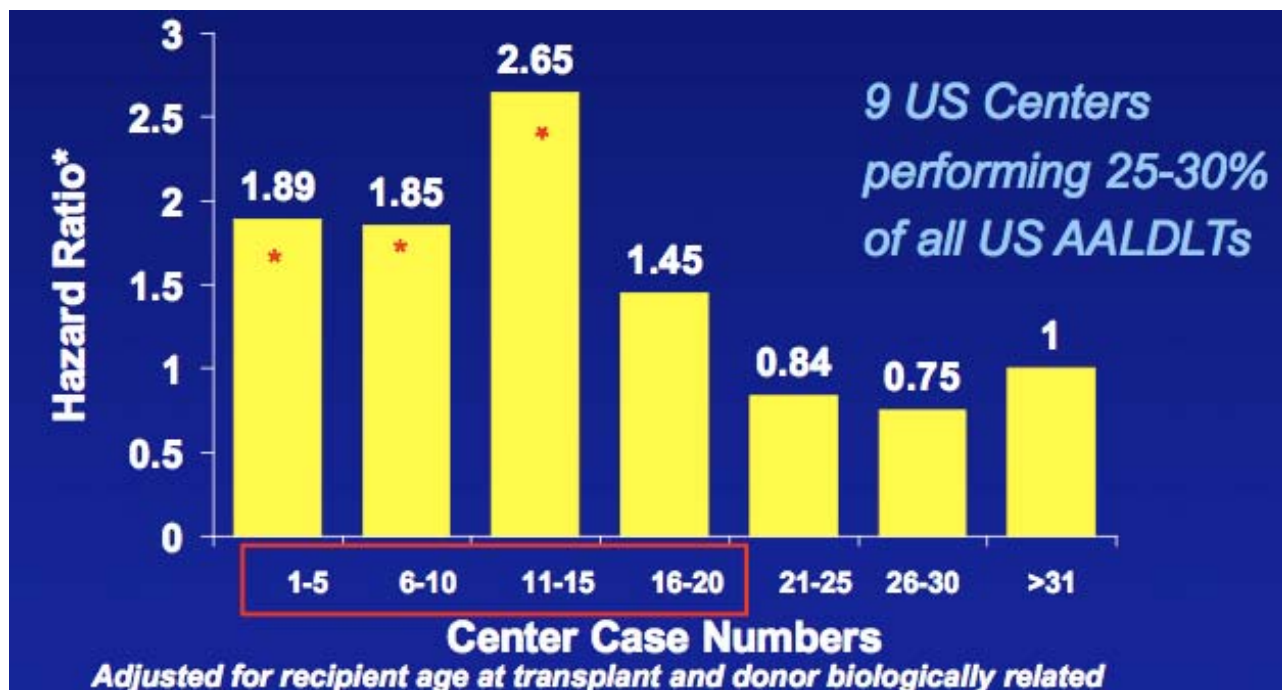
DDLT – 1.1%

LDLT ≤ 20 – 7.8%

LDLT > 20 – 3.6%

A2ALL - SIGNIFICANT PREDICTORS OF MORTALITY

- MELD Score
- Dx of HCC
- Recipient Age
- **CENTER EXPERIENCE**
 - Pts receiving tx from a center that had ≥ 20 had a 64% reduced risk of death than those that did not



Outcomes in Hepatitis C Virus-Infected Recipients of Living Donor vs. Deceased Donor Liver Transplantation

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~Background: Some previous studies have shown that in HCV, LDLT had higher rate of graft failure than DDLT

~A2ALL: 1998 – 2003

	LDLT (n = 181) Median (range) or n (%)	DDLT (n = 94) Median (range) or n (%)	P Value*
Recipient age (years)	50.5 (29–71)	52.3 (30–74)	0.17
Male recipients	119 (66)	68 (72)	0.27
Caucasian recipients	166 (92)	84 (89)	0.52
Patients with pre-LT HCC	36 (20)	27 (29)	0.10
Laboratory MELD at transplantation†	14.0 (6–40)	18.0 (7–40)	<0.0001
Donor age (years)	37.7 (19–57)	41.0 (9–72)	0.07
Male donors†	90 (50)	52 (63)	0.03
Cold ischemia time (minutes)	46.0 (5–480)	399.0 (12–600)	<0.0001

HCV GRAFT SURVIVAL

- **UNADJUSTED DATA:**
LDLT worse than DDLT

TABLE 2. Primary Causes of Graft Loss

	LDLT (n = 34) n (%)	DDLT (n = 6) n (%)
Recurrent HCV	8 (24)	2 (33)
Recurrent HCC	1 (3)	0 (0)
Vascular complications	7 (21)	0 (0)
Primary nonfunction	7 (21)	0 (0)
Infection	3 (9)	2 (33)
Biliary complications	2 (6)	1 (17)
Other	6 (18)	1 (17)

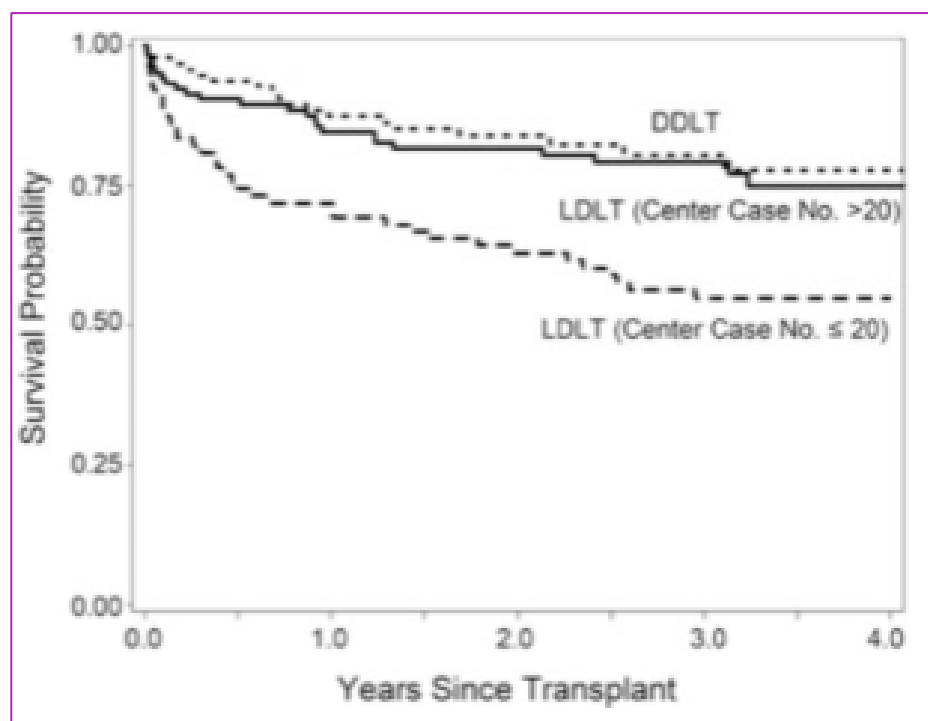
- **ADJUSTED DATA:**
No diff bw LDLT>20 and DDLT

3-Year Graft Survival

DDLT – 80%

LDLT >20 – 79%

LDLT ≤20 – 55%



FUTURE

- LDLT for Fulminant Failure?
 - Done in other countries
- Liver Defatting
 - Animal Models
- LDLT in KY?



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