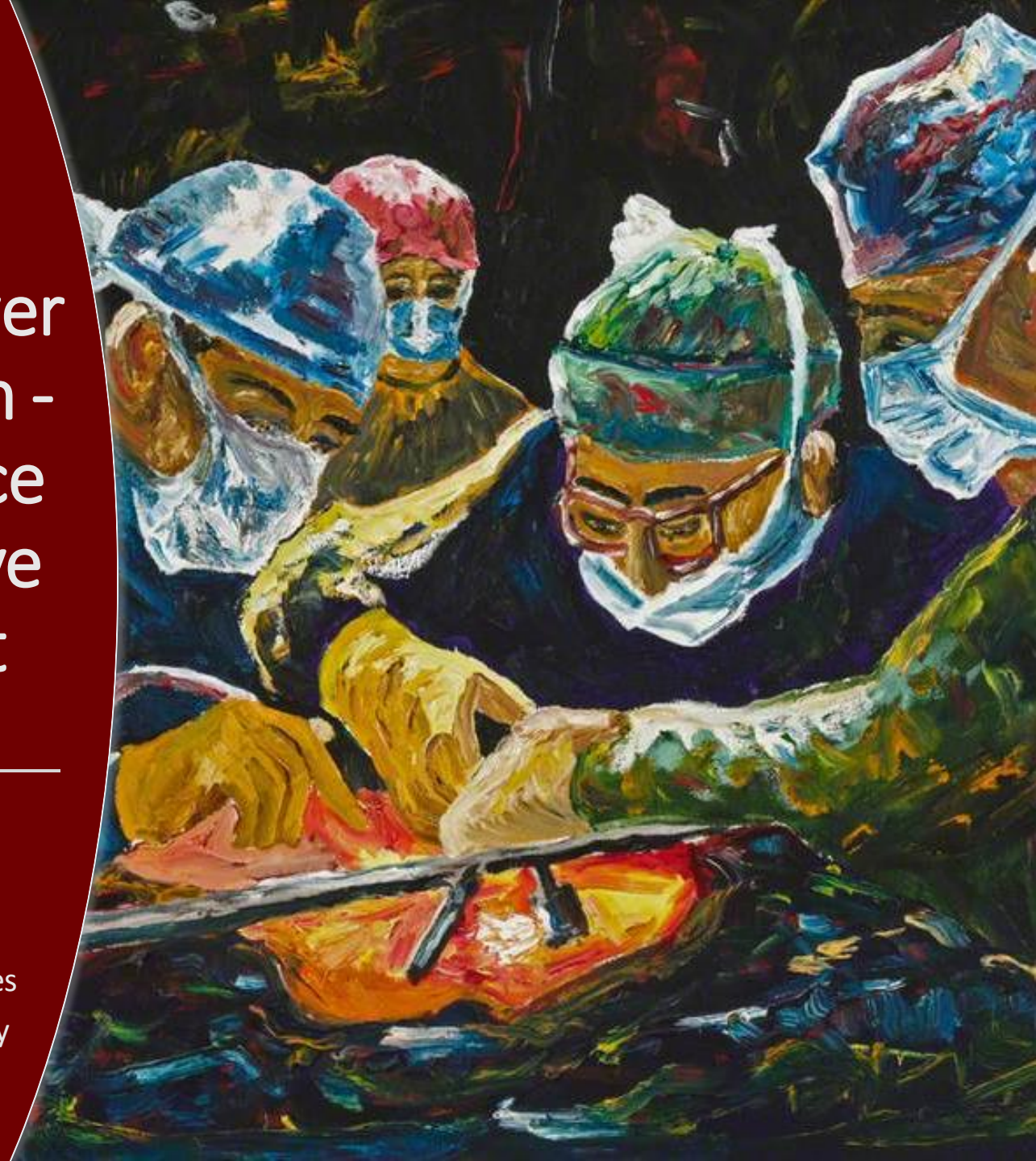
Living donor liver transplantation - current practice & perioperative management

Kambiz Etesami, MD
Associate Director of Liver Transplantation
Children's Hospital Los Angeles
Assistant Professor of Surgery
Keck Hospital of USC



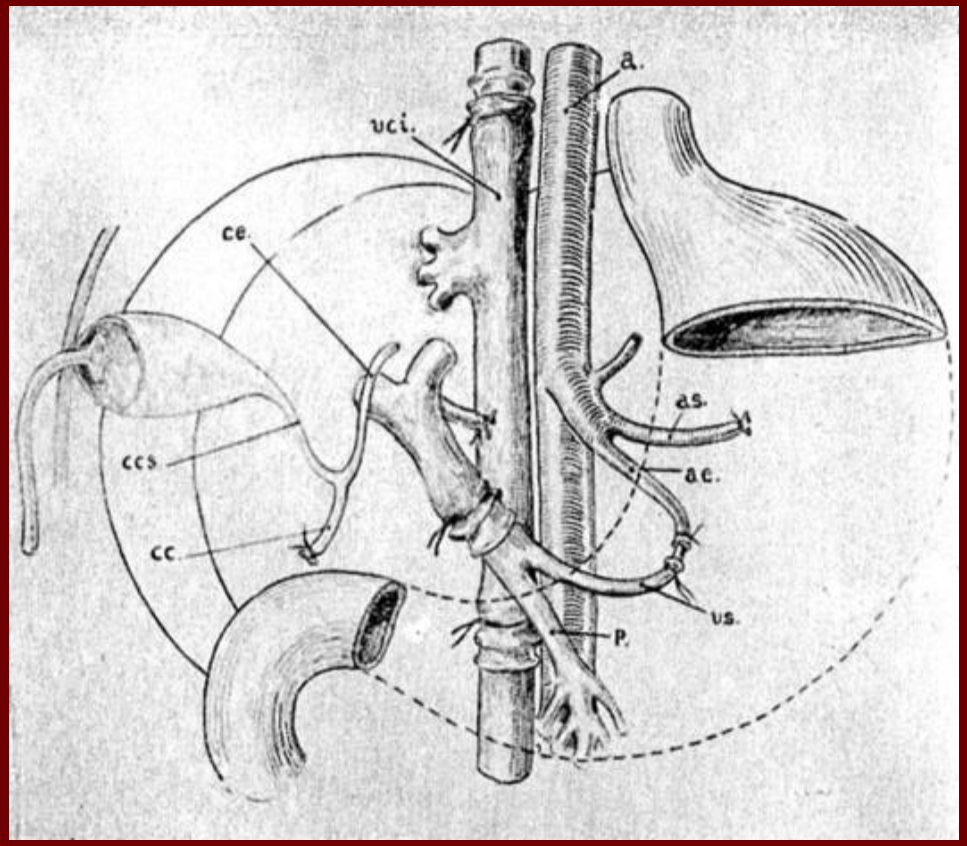
Published in final edited form as:
J Am Coll Surg. 2002 November ; 195(5): 587–610.

The Saga of Liver Replacement, with Particular Reference to the Reciprocal Influence of Liver and Kidney Transplantation (1955–1967)

Thomas E Starzl, MD, PhD, FACS
Thomas E Starzl Transplantation Institute, Pittsburgh, PA.

Vittorio Staudacher 1913-2005

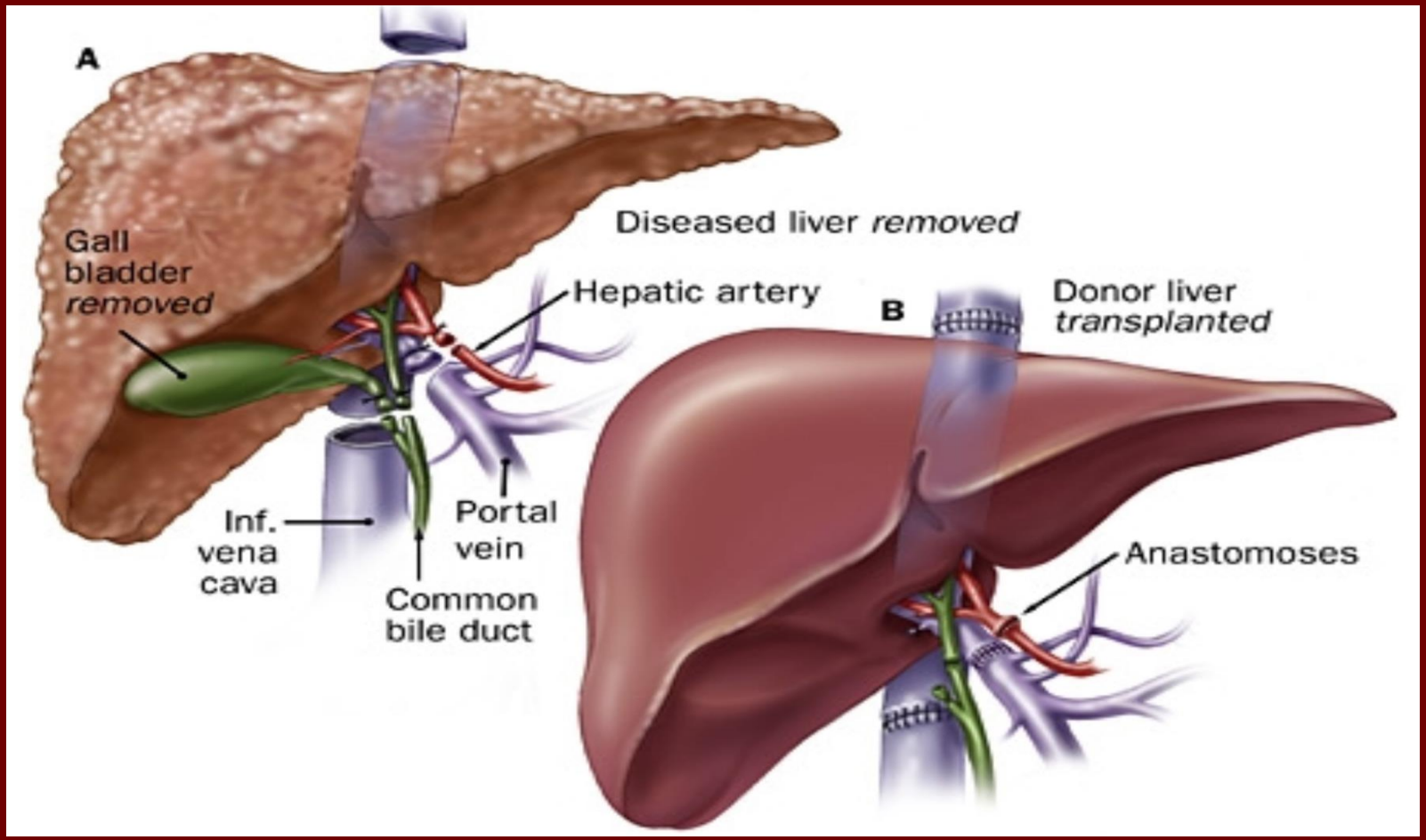
Canine OTLT - University of Milan, 1952

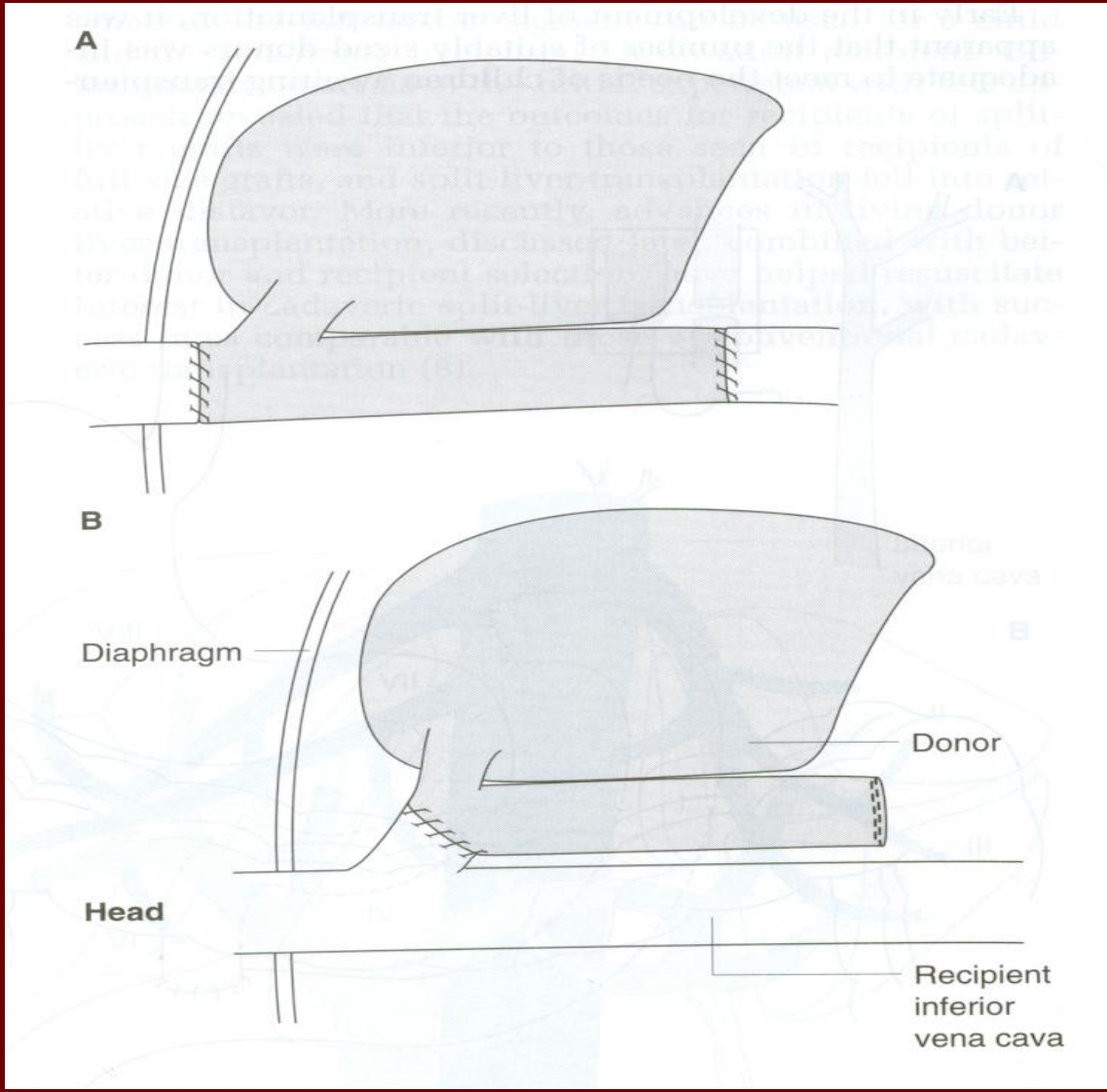


Thomas E. Starzl 1926 – 2017

First LT in humans - University of Colorado, 1963

DDLT Technique




A
B
Diaphragm
Donor
Head
Recipient
inferior
vena cava

Developments in immunosuppression *prior to first human LT*

1. Cytoablation with sublethal doses of total body radiation (450R).
2. 6-MP
3. Azathioprine
4. Prednisone

First liver transplant, 3/1/1963

Child with BA – bled to death in the OR.

Six more attempts made in 1963 (5 in Denver, 1 each in Boston & Paris)

1. All with short term mortality.
2. Self imposed world-wide moratorium until 1967.

In the interim

1. Advances in technique.
2. Further development in immunosuppression – Antilymphocyte globulin (ALG), "triple drug cocktail."
3. Better preservation techniques.
4. Concept of brain death.
5. 1968 – Present notable for improved outcomes, addition of cyclosporine (1978) & FK506 (1990s).


WHEN I PROMISE TO COME UP WITH AN ORGAN TRANSPLANT PUN
I DE-LIVER

Indications for Liver Transplantation

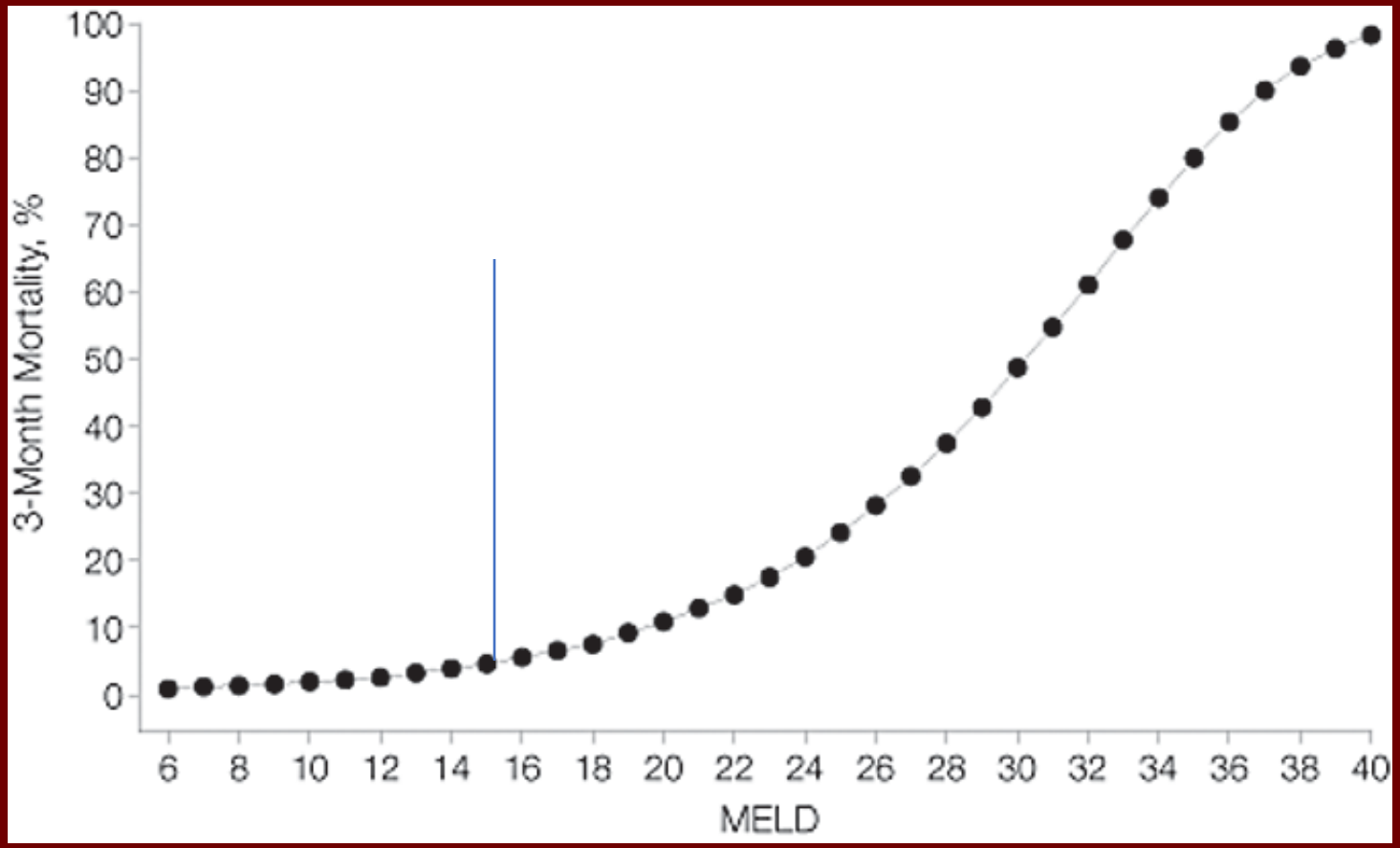
- Acute Liver Failure
- Chronic Liver Failure
- Neoplastic Liver Disease
- Inborn Errors of Metabolism

Contraindications to LT

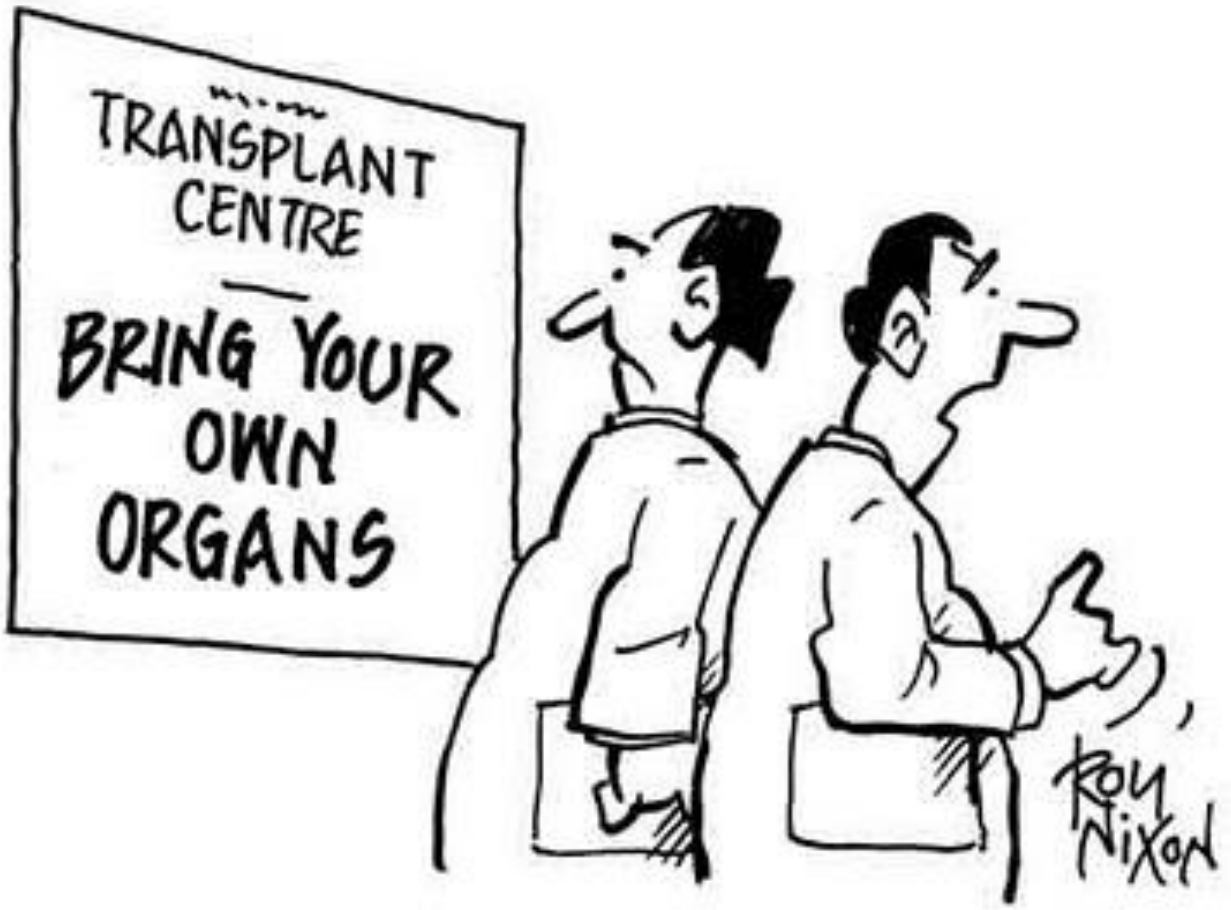
- Absolute
  - Severe cardiopulmonary disease which is uncorrectable
  - Active extrahepatic malignancy
  - Active substance abuse
  - Active systemic infection

- Relative
  - AIDS (less so today)
  - Advanced age
  - Super Obesity
  - Severe psychiatric disease
  - Poor compliance
  - Significant mesenteric vascular thromboses
  - Multiple prior abdominal surgeries

MELD Score and Probability of 3 Month Mortality without Liver Transplant



Larson, A. M. et al. JAMA 2006;295:2168-2176



"I HAD NO IDEA THINGS WERE QUITE SO DESPERATE."

Donor types

- Standard criteria – split vs. whole allograft
- PHS increased risk
- DCD
- Expanded criteria donor (ECD)
  - Donor age >70
  - Donor age >60 with significant medical history
  - Donors with HBV/HCV exposure
- Living donor
- Domino donor

American Journal of Transplantation

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AND THE AMERICAN SOCIETY OF TRANSPLANT SURGEONS

WILEY-BLACKWELL

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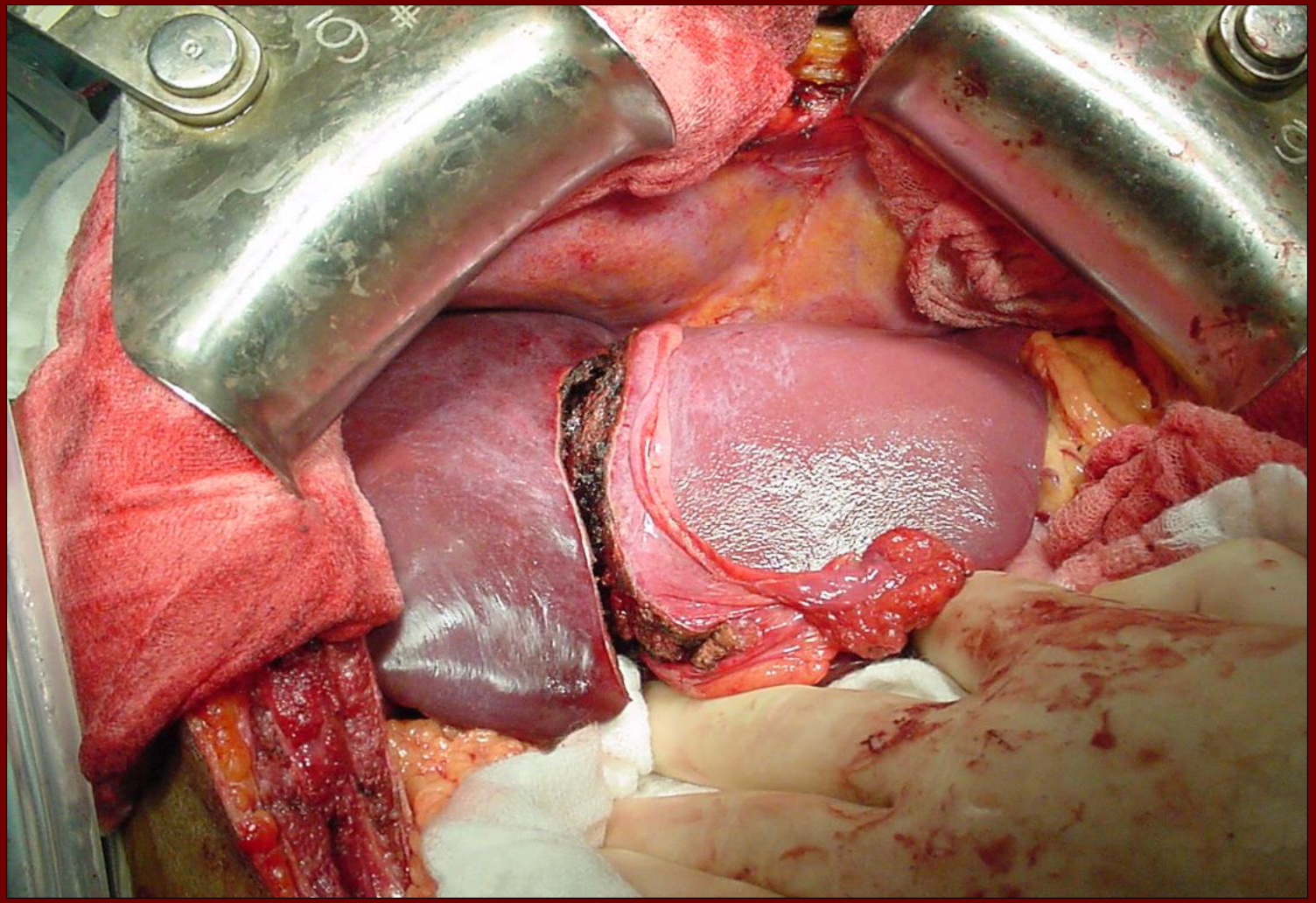
Living Donor Liver Transplant (LDLT)



LDLT Overview

First reported case, Strong et. al. 1989 (pediatric)

First adult LDLT cases in US performed in 1997-98

~5000 performed since in 89 centers

Steady increase in the last five years

Continues to represent a very small component in this country (~5%)

There are individual centers around the world, primarily in Asia, with larger annual cohorts (~75% in South Korea)

LDLT Overview

Similar indications as DDLT

Recipients tend to be “healthier” – less portal hypertension, less metabolic liver derangements, better able to tolerate a smaller graft

Planned operation

Heavy scrutiny

Technically challenging

~80% of donors would donate again

~2 month to return of regular baseline function

LDLT Outcome

Outcomes similar to DDLT

~0.5 % mortality, 25-30% morbidity risk for donor

Graft failure occurs in

- 5.9% at 6 months
- 7.1% at one year
- 13.8% at 3 years
- 23.7% at 5 years
- 32.1% at 10 years

Recipient survival

- 5.3% mortality at 6 months
- 7.4% at one year
- 13.1% at 3 years
- 19.7% at 5 years
- 39.5% at 10 years

LDLT Complications

Pulmonary embolism

Myocardial infarction

Peptic ulcer disease

Liver failure

Death

LDLT Complications

Table 2
Type of complications of donors in the Adult-to-Adult Living Donor Liver Transplant Cohort Study

A2ALL Study, Year of Publication	Number of Donors Who Successfully Donated[a]	Reported Common Complications
Ghobrial et al,[12] 2008	393	• Bacterial infections (12%) • Biliary leaks (9%) • Incisional hernias (6%) • Pleural effusions requiring intervention (5%) • Neuropraxia (4%) • Wound infections (3%) • Reexplorations (3%) • Intraabdominal abscess (2%).
Abecassis et al,[49] 2012	740	• Bacterial infections (12.5%) • Biliary complications (9.7%) • Intraoperative complications (6%) • Incisional hernias (5.6%) • Pleural effusions (5.3%) • Psychological difficulties (4.1%) • Reexplorations (3%)

Gastroenterol Clin N Am 47 (2018) 297–311

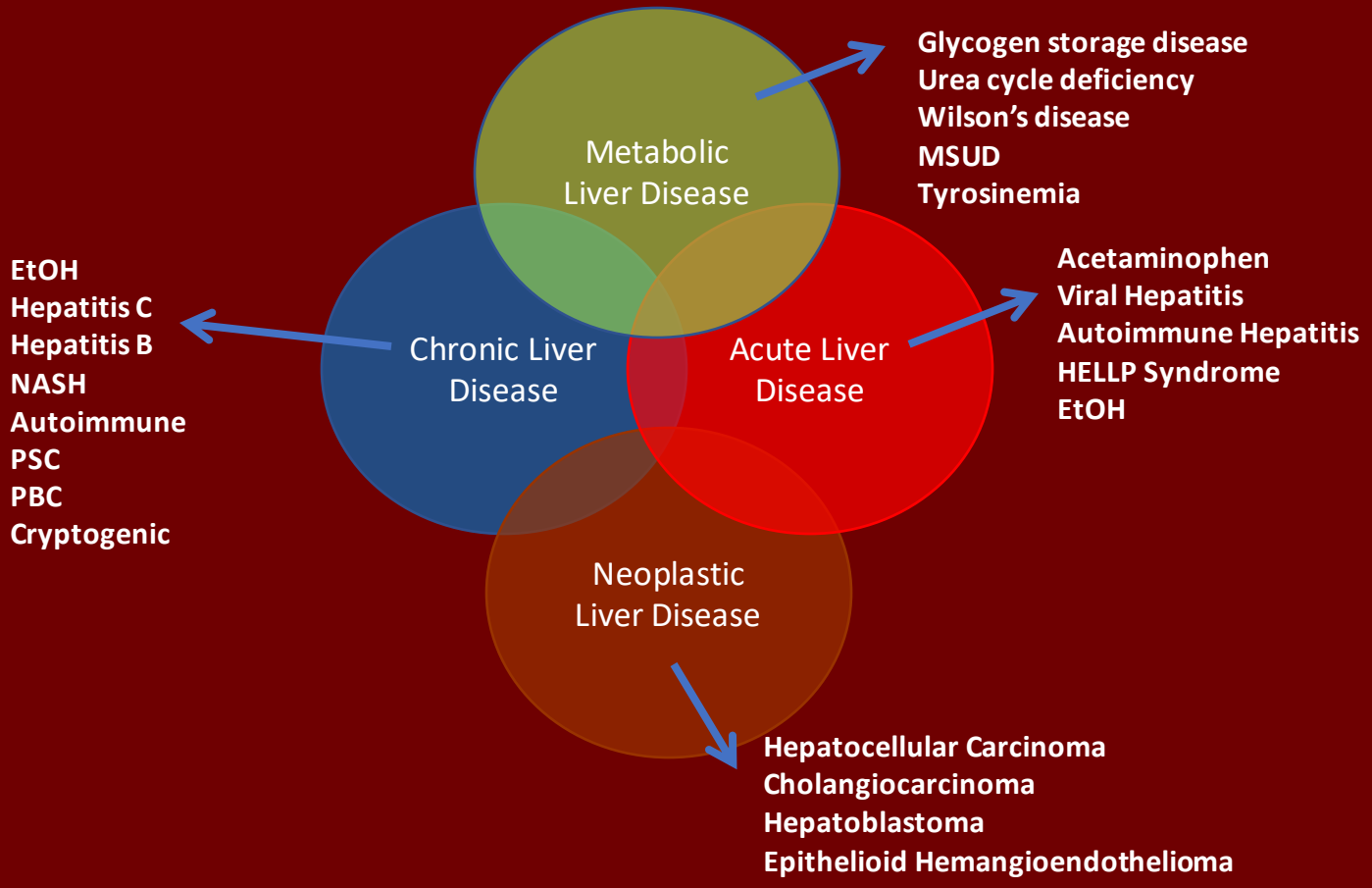
LDLT vs. DDLT Complications

Table 1
Probability of specific complications in recipients of living or deceased donor liver transplantation

		Overall Complication Rate		Log-Rank
	Complication	LDLT	DDLT	*P* Value
Significantly higher in LDLT	Bile leak or biloma	0.26	0.09	<0.0001
	Blood infection	0.26	0.15	0.0091
	Biliary stricture	0.32	0.21	0.0002
	Biliary tree infection	0.14	0.06	0.0062
	Hepatic artery thrombosis	0.06	0.04	0.0378
Significantly higher in DDLT	Pulmonary edema	0.1	0.36	<0.0001
	Ascites	0.21	0.25	0.0151
	Cardiac complication	0.02	0.06	0.0008
	Intraabdominal bleeding	0.05	0.08	0.0190

Gastroenterol Clin N Am 47 (2018) 297–311

LDLT Indications



LDLT Indications

Table 1 Indications for living donor liver transplantation in the USA

Low MELD + complications of cirrhosis
HCC outside tumor criteria with favorable tumor biology
HCC within tumor criteria in regions with long (>1 year) wait
Low MELD + cirrhosis + significantly decreased quality of life
Low MELD + cholestatic liver disease with recurrent cholangitis

MELD, model for end-stage liver disease; HCC, hepatocellular carcinoma.

HepatoBiliary Surgery and Nutrition, Vol 5, No 2 April 2016

Challenges to LDLT in the United States

- Prevalence of deceased donor transplantation
- Risk-averse culture
- Steep learning curve
- Diffusion of expertise
- Institutional “burden”
- Acuity of illness in recipient populations
  - Previous surgery, obesity, PVT
- Comorbidities in donor patient population
  - obesity, fatty liver
  - Anatomic variations
  - 60-80% denied after work up completed

First, do no harm*

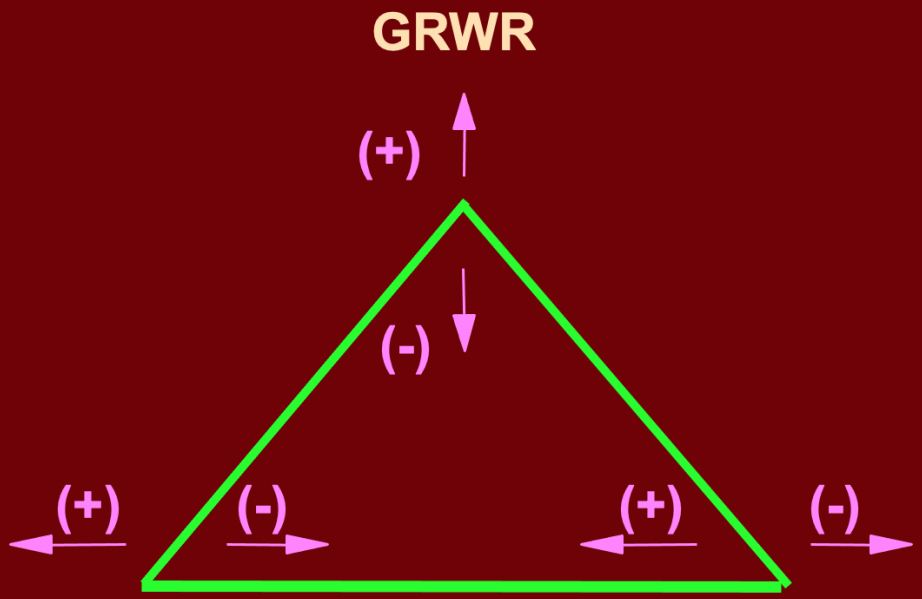
- Staged evaluation process
- Informed consent at every step
- Independent donor advocate
  - Support for donor / counseling
  - Provide access to prior donors
- Risk stratification including
  - - Age
  - - Medical / Surgical history
  - - ABO compatibility
  - - Psychiatric profile
- Diagnostics
  - X-ray, EEG, echocardiogram, CT, MRI/MRCP, blood panels including hypercoagulable workup – factor V Leiden mutation, Protein C, S, ATIII levels

First, do no harm*

- Ethical dilemma
- Opposing interests between donor and recipient needs
  - The more liver you take (the greater the graft to body weight ratio – GRBWR)
    - Improved outcome for recipient
    - Increasing danger for donor

	Advantages	Disadvantages	Requirements
Right Lobe	good volume for recipient	large loss of donor volume (≈70% SLV)	donor to maintain ≥ 30% SLV after donation recipient to receive ≈ .8% GRWR
Left/Caudate Lobe	better volume than left lobe alone helps to overcome SFSS		
Left Lobe	good volume for small recipients less donor liver removed	small, donated mass/volume risk of SFSS	
Dual Grafts	helps to overcome donor/recipient size mismatch	needs to be performed in highly specialized centers	

Balance of Critical Factors for Success in LDLT



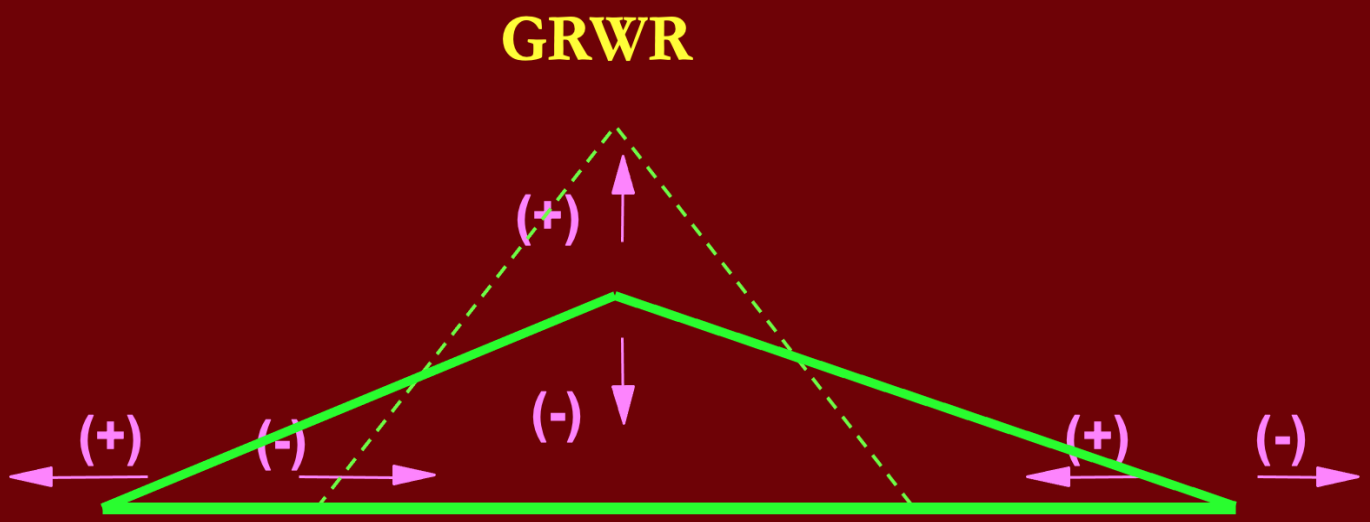
outflow capacity

portal hypertension

The larger the size of the triangle, the greater the *functional graft size*

Adopted from T. Fishbein

Balance of Critical Factors for Success in LDLT



This is the balance that is necessary for success when using a smaller allograft, eg; left lobes

Adopted from T. Fishbein

First, do no harm*

Find balance between adequacy for donor and recipient

Asan Medical Center Criteria

- **≤ 35 years and no fatty change**
  - **30% remnant liver volume (RLV): Acceptable**
- **≤ 35 years and ≤ 15% fatty change**
  - **30–35% RLV: Acceptable**
- **≤ 35 years and ≤ 30% fatty change**
  - **35% RLV: Acceptable**
- **35 – 55 years and ≤ 15% fatty change**
  - **>35% RLV: Acceptable**

Absolute contraindications = BMI > 30 kg/m in age > 30, > 30% steatosis, < 30% RLV

First, do no harm*

ILTS Criteria

- **18-60 years old**
- **Donor remnant volume no less than 30-35%**
- **Macrosteatosis > 30% is absolute contraindication**
- **Separation of donor and recipient teams**
- **Perioperative plan including pain management**
- **Anesthesia consultation prior to date of surgery**
- **“Cooling off period”**

First, do no harm* Summary

Attain GRBWR ≥ 0.8%

Donor LRV of ≥ 30%

Donor steatosis ≤ 30 %

Rule out risk of disease transmission

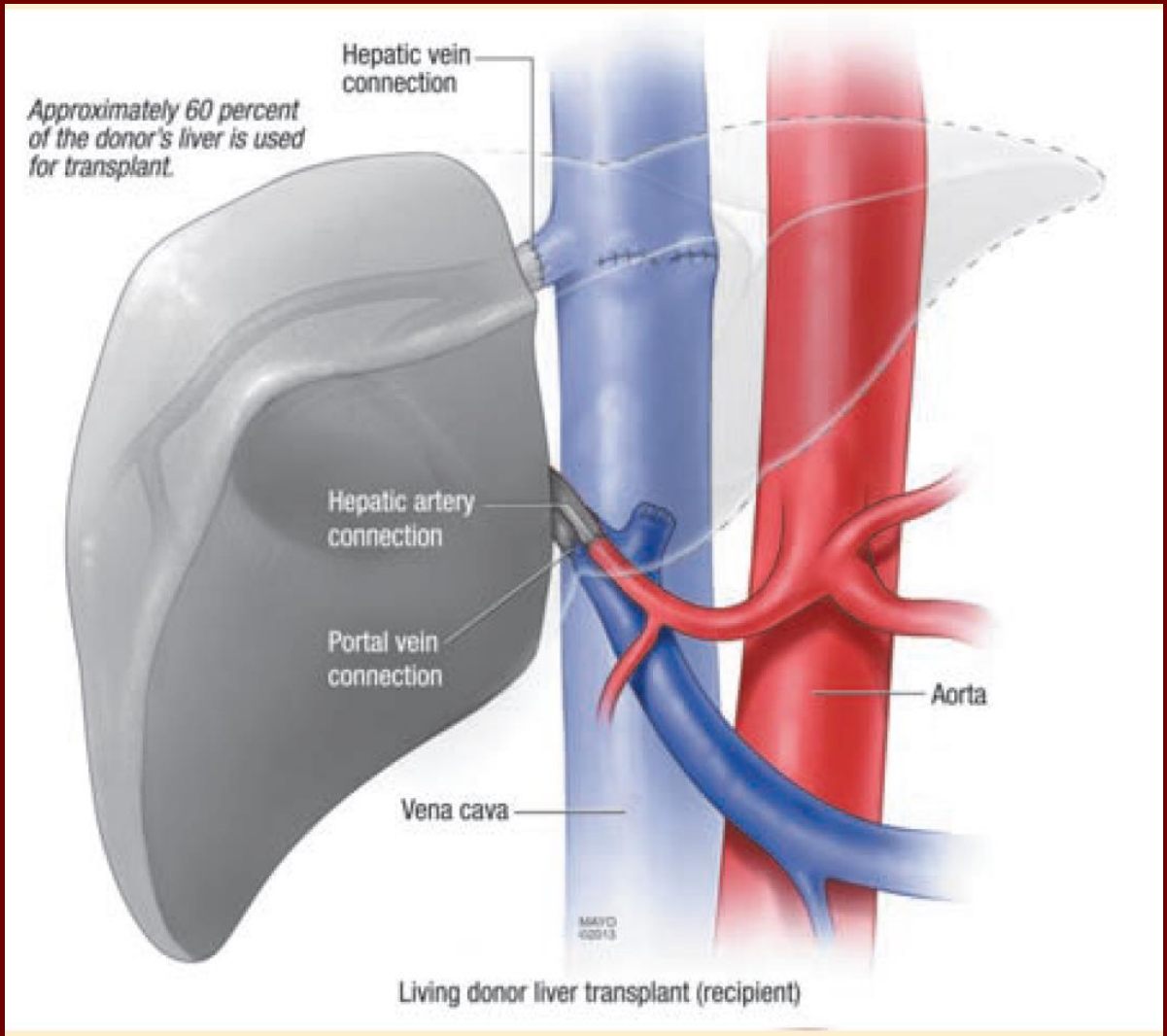
Informed consent on surgical, medical, financial, and psychological risks, including death

- 0.1 % for left & 0.5% for right liver donors
- 20 – 35% morbidity rate, including 0.04% transplantation rate

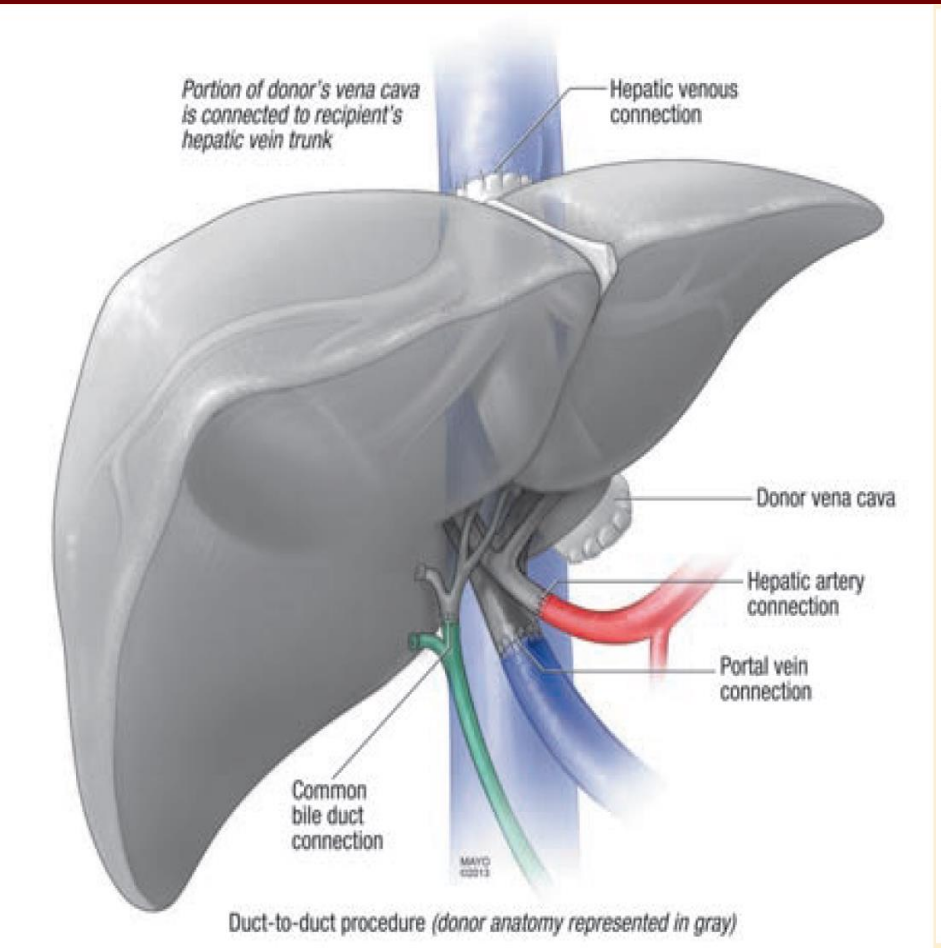
Independent donor advocate

Return to baseline performance & psychological status in ~ 1 year

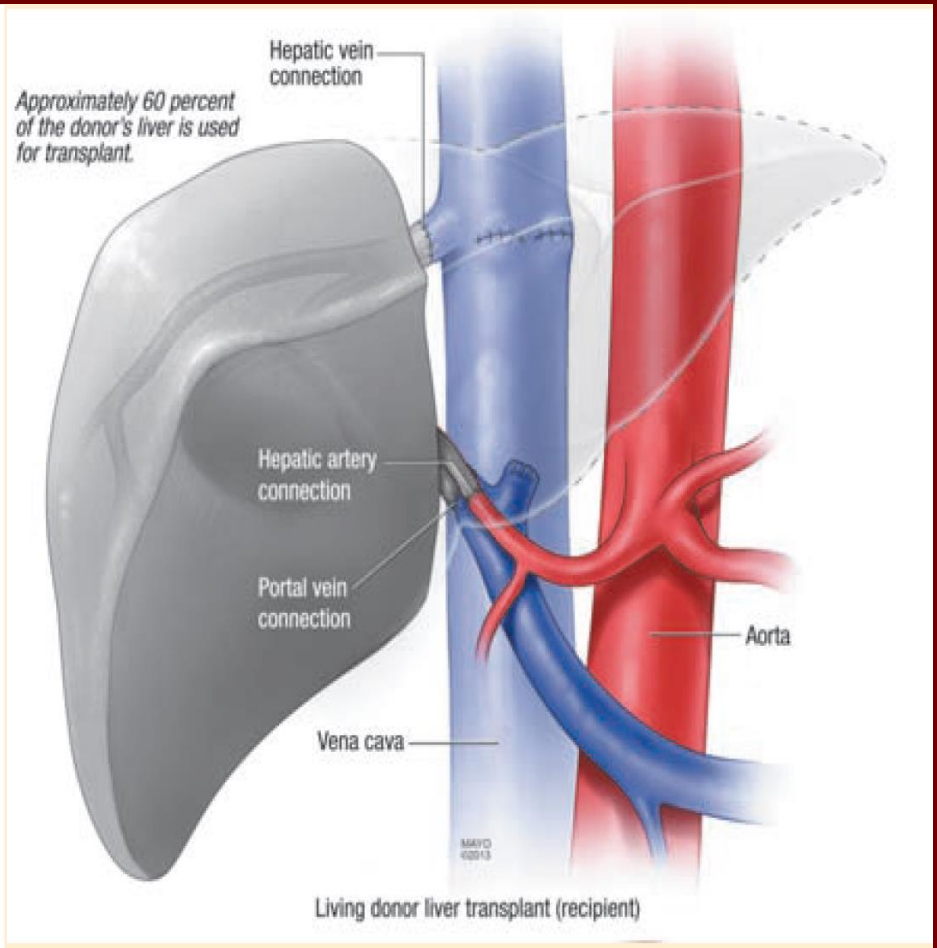
LDLT Technique



DDLT vs. LDLT Technique



Duct-to-duct procedure *(donor anatomy represented in gray)*



Living donor liver transplant (recipient)

LDLT Anatomy

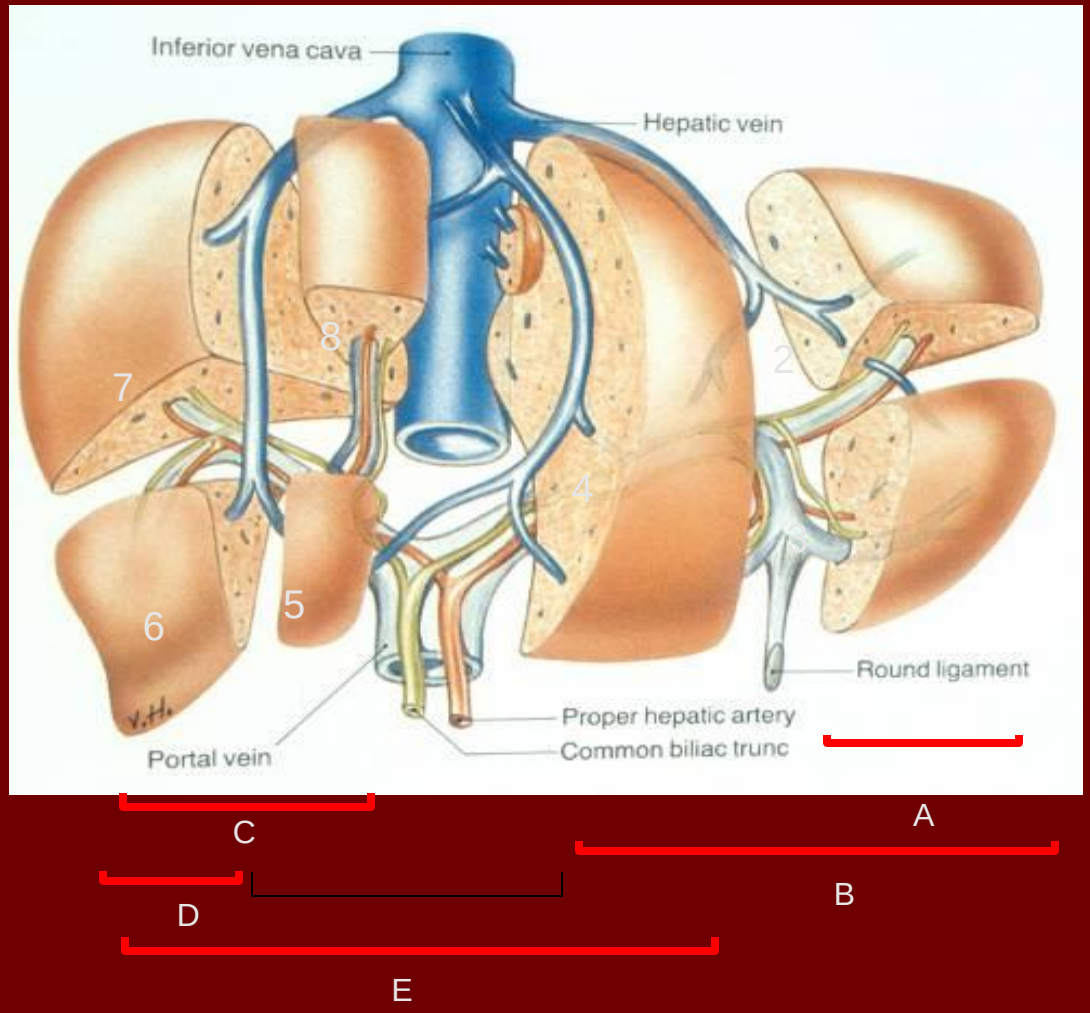
A) Left lateral section (S2 and 3)

B) Left lobe (S2, 3 and 4)
With/without MHV
With/without caudate

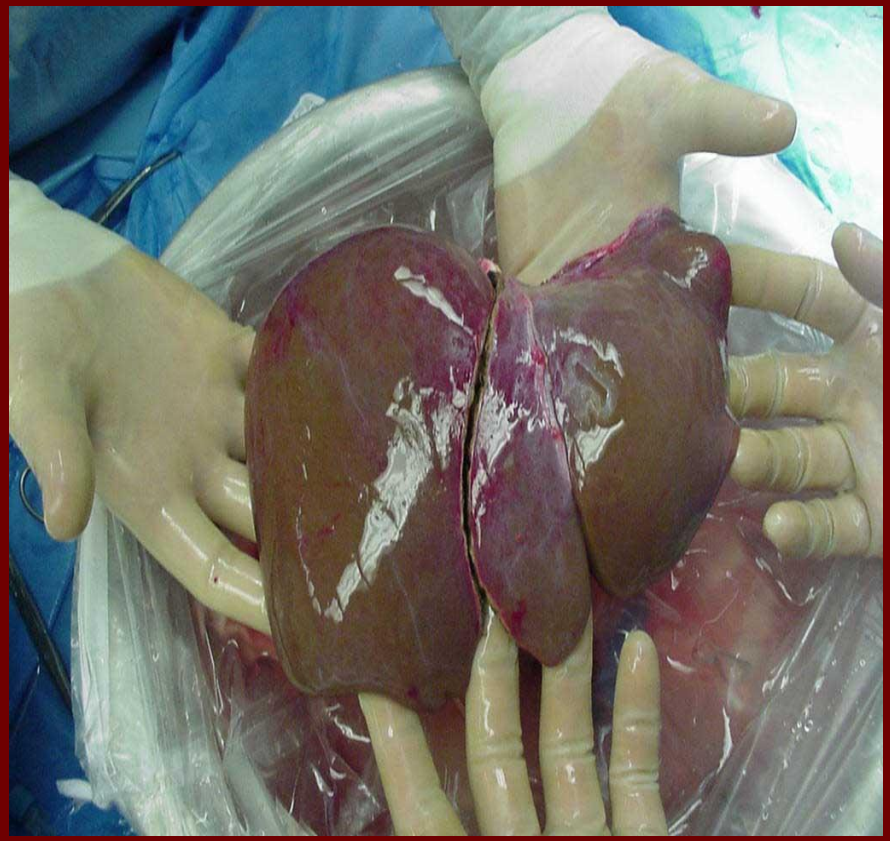
C) Right lobe (S5, 6, 7 and 8)
With/without MHV

D) Right posterior (S6 and 7)

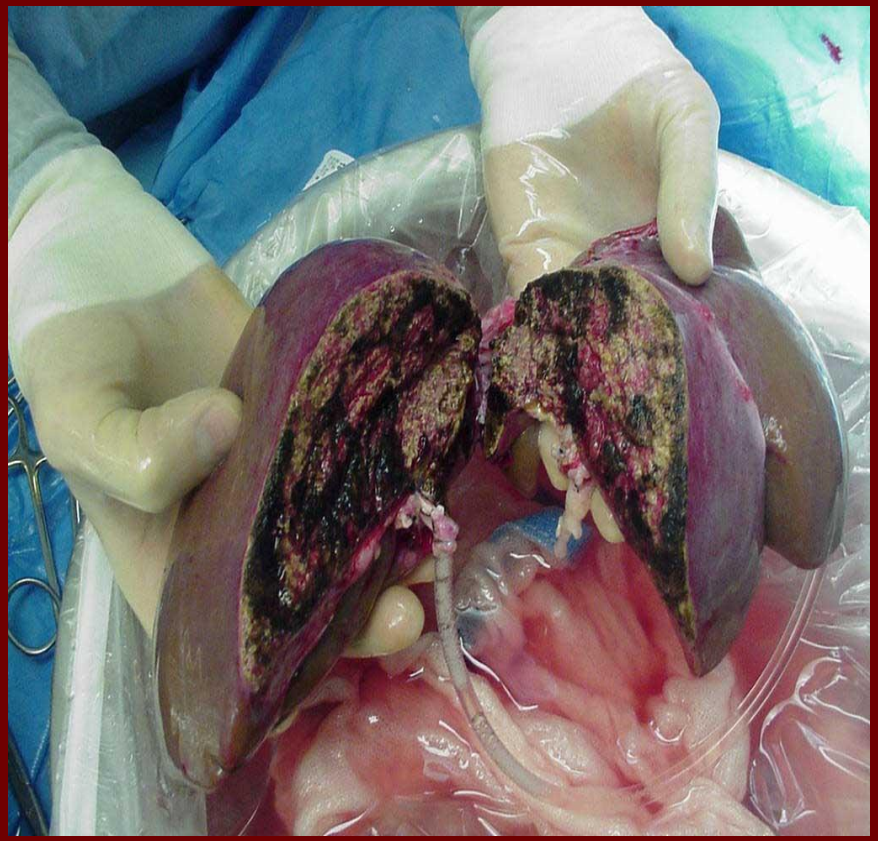
E) Right trisegment (S4-8)



LDLT Anatomy

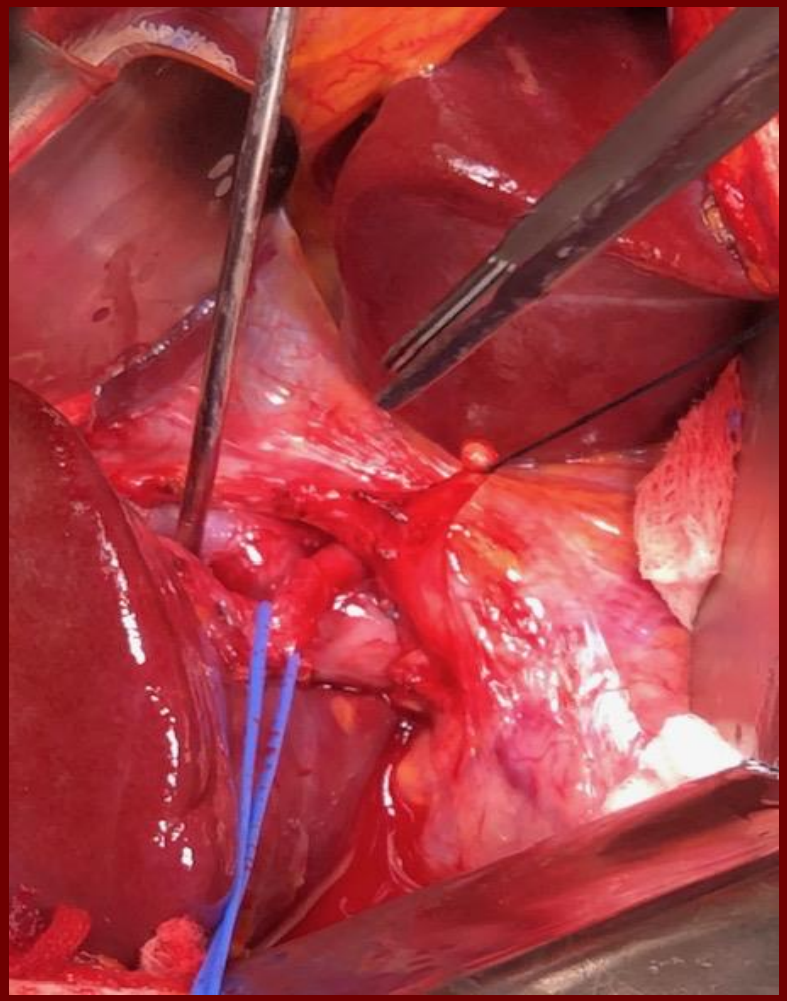


Right segment

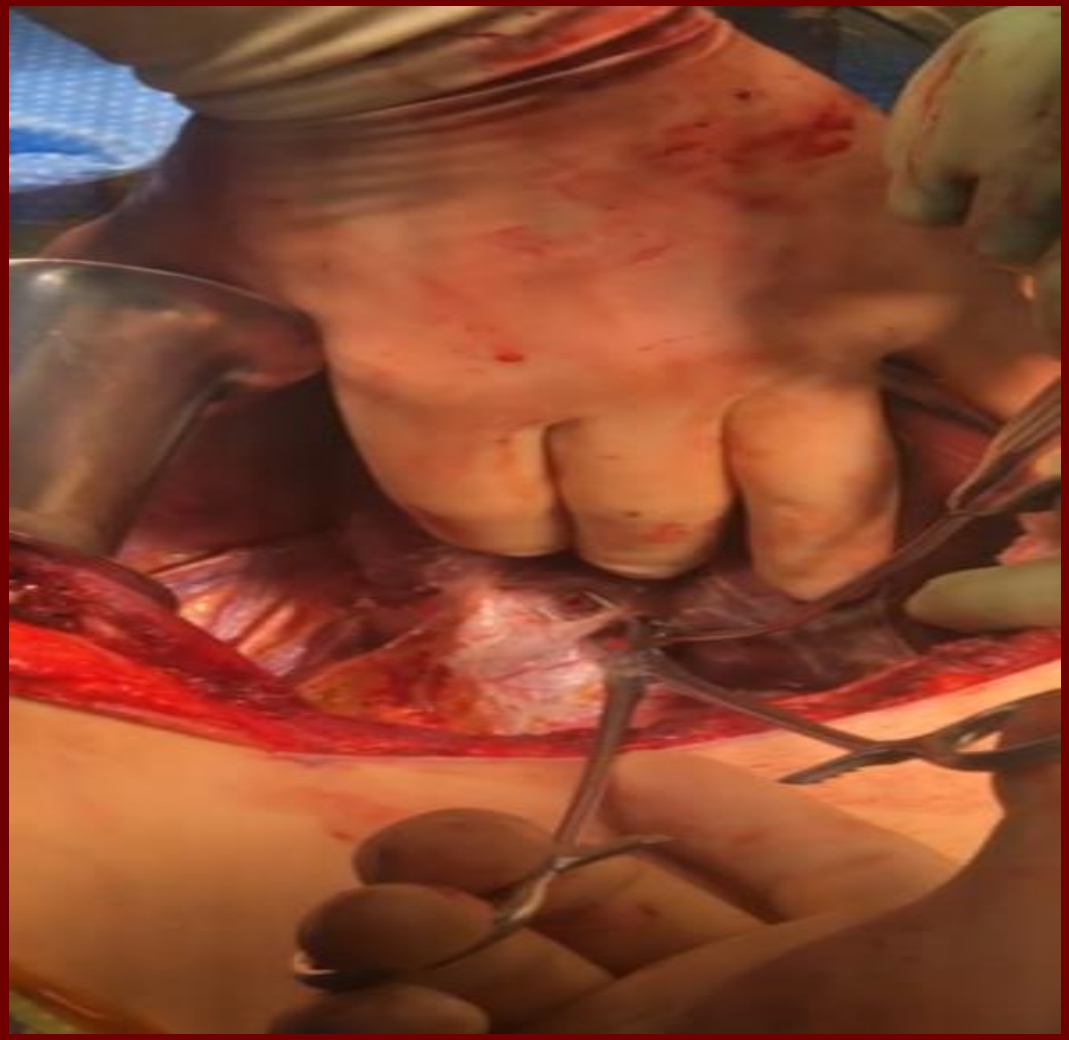


Left segment

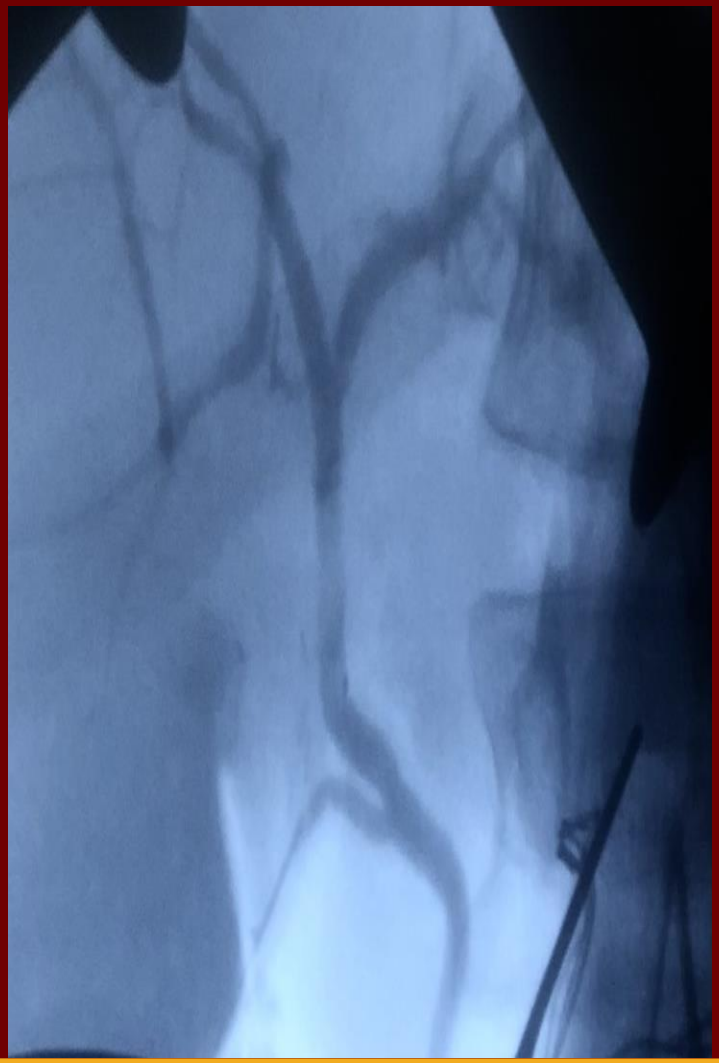
LDLT Donor Hepatectomy – hepatic hilum

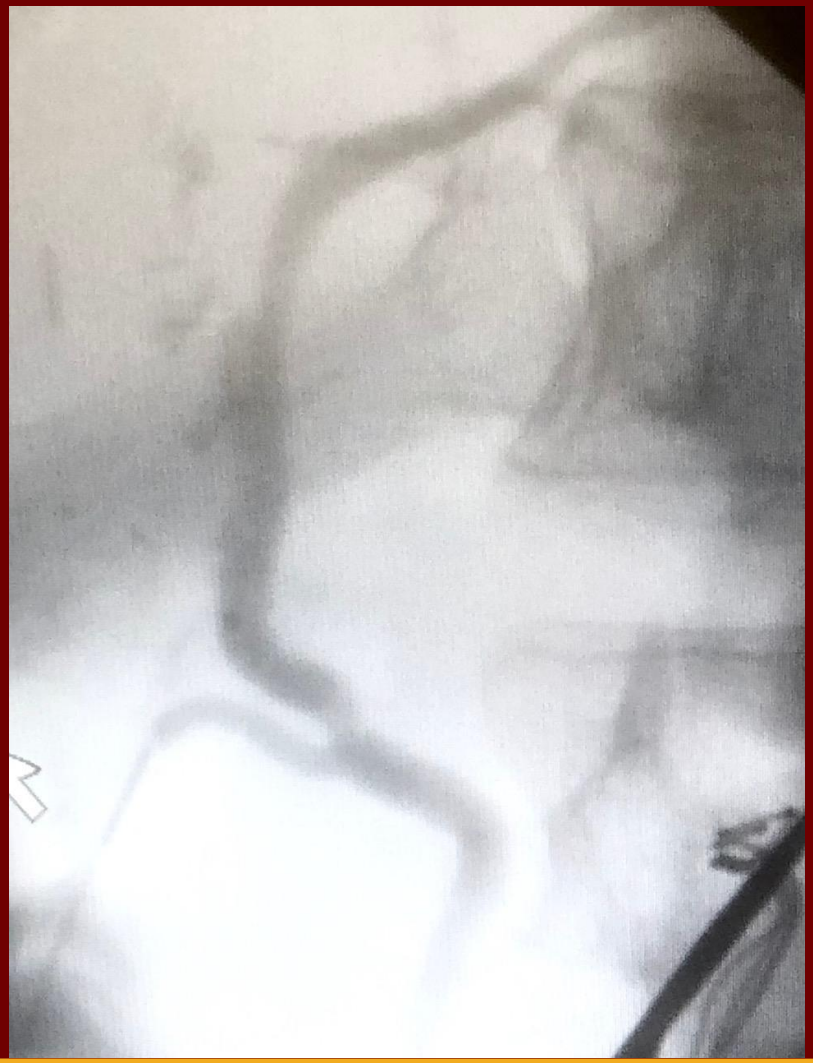


LDLT Donor Hepatectomy – caval sparing

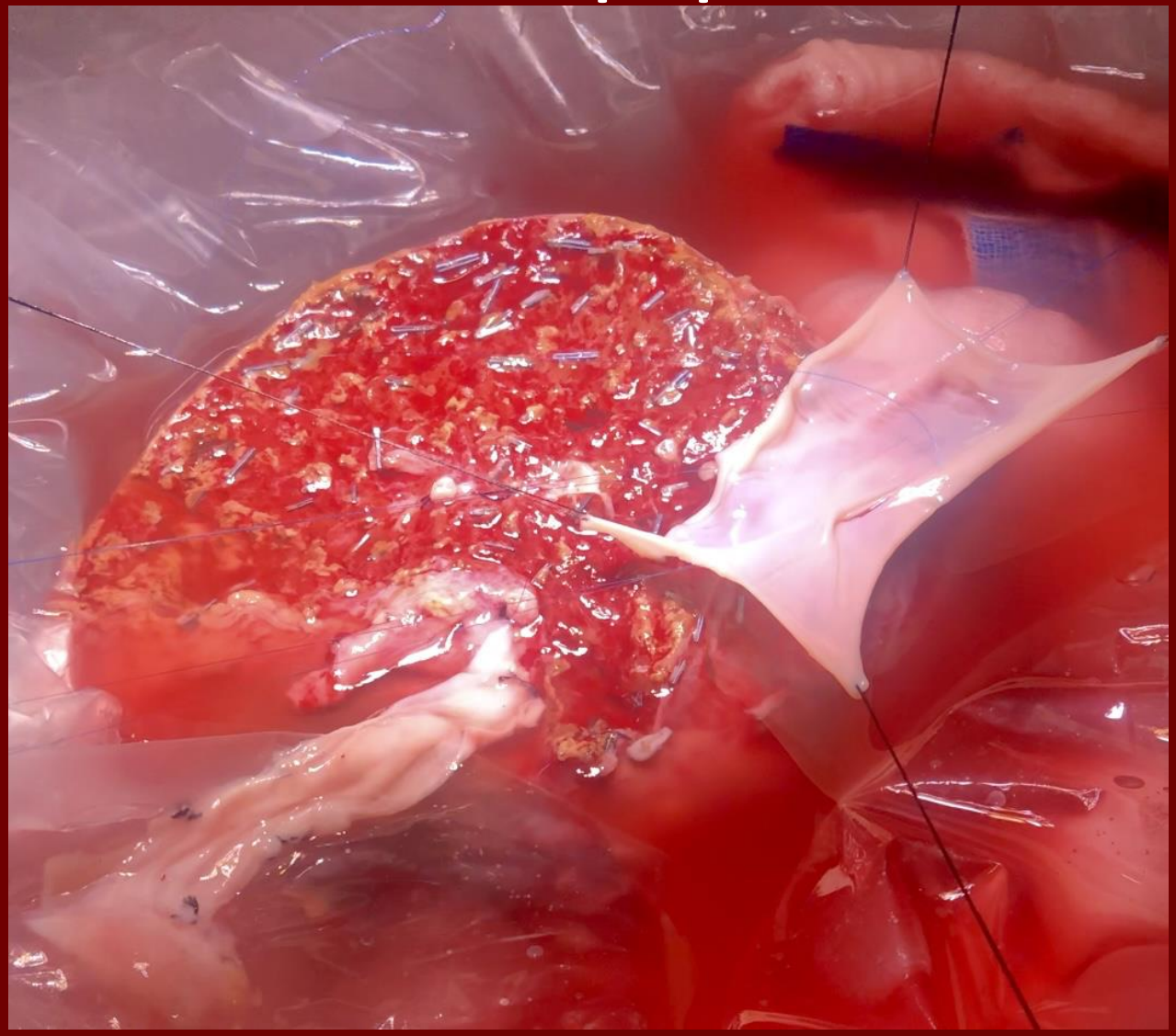


Donor cholangiogram

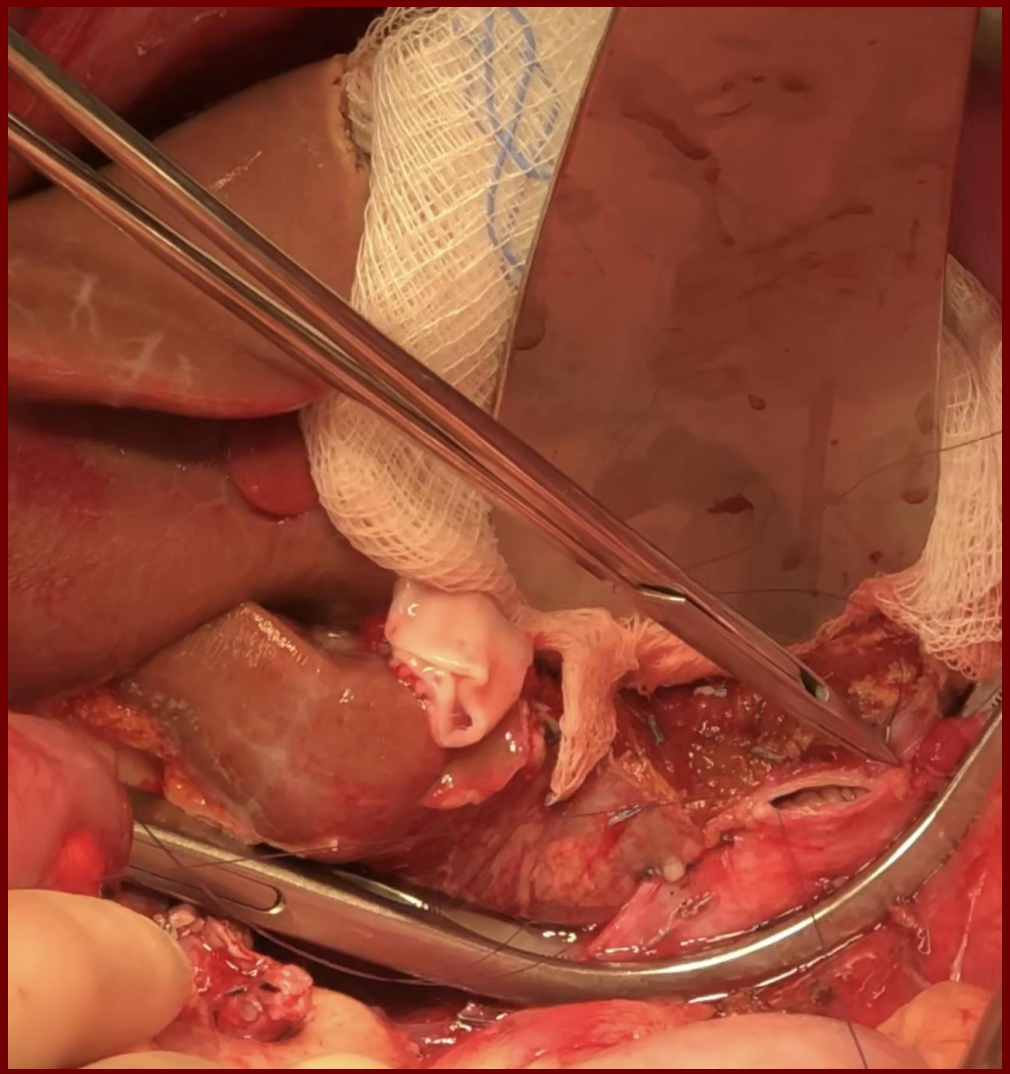




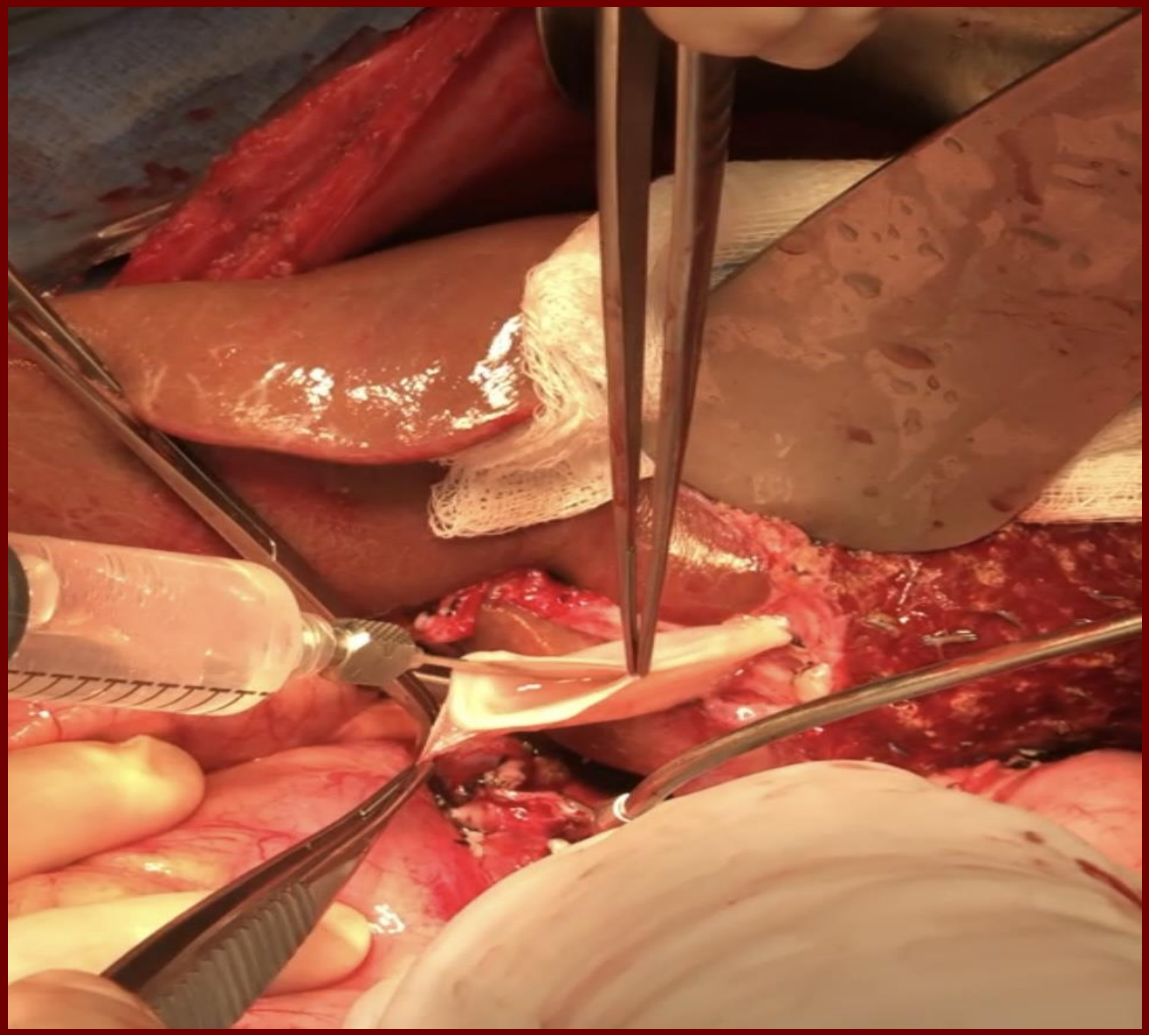
LDLT Donor “back table” preparation



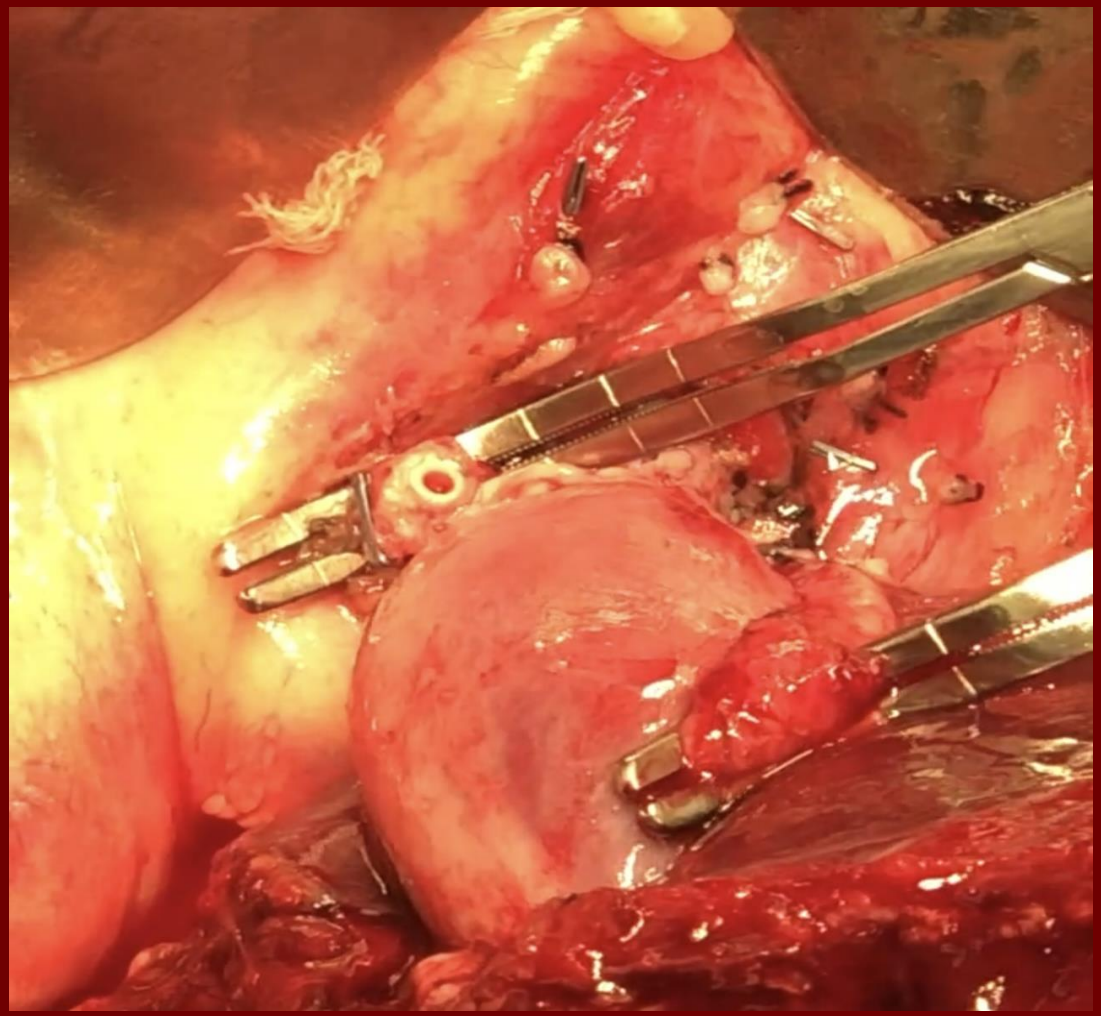
LDLT Recipient – venous outflow



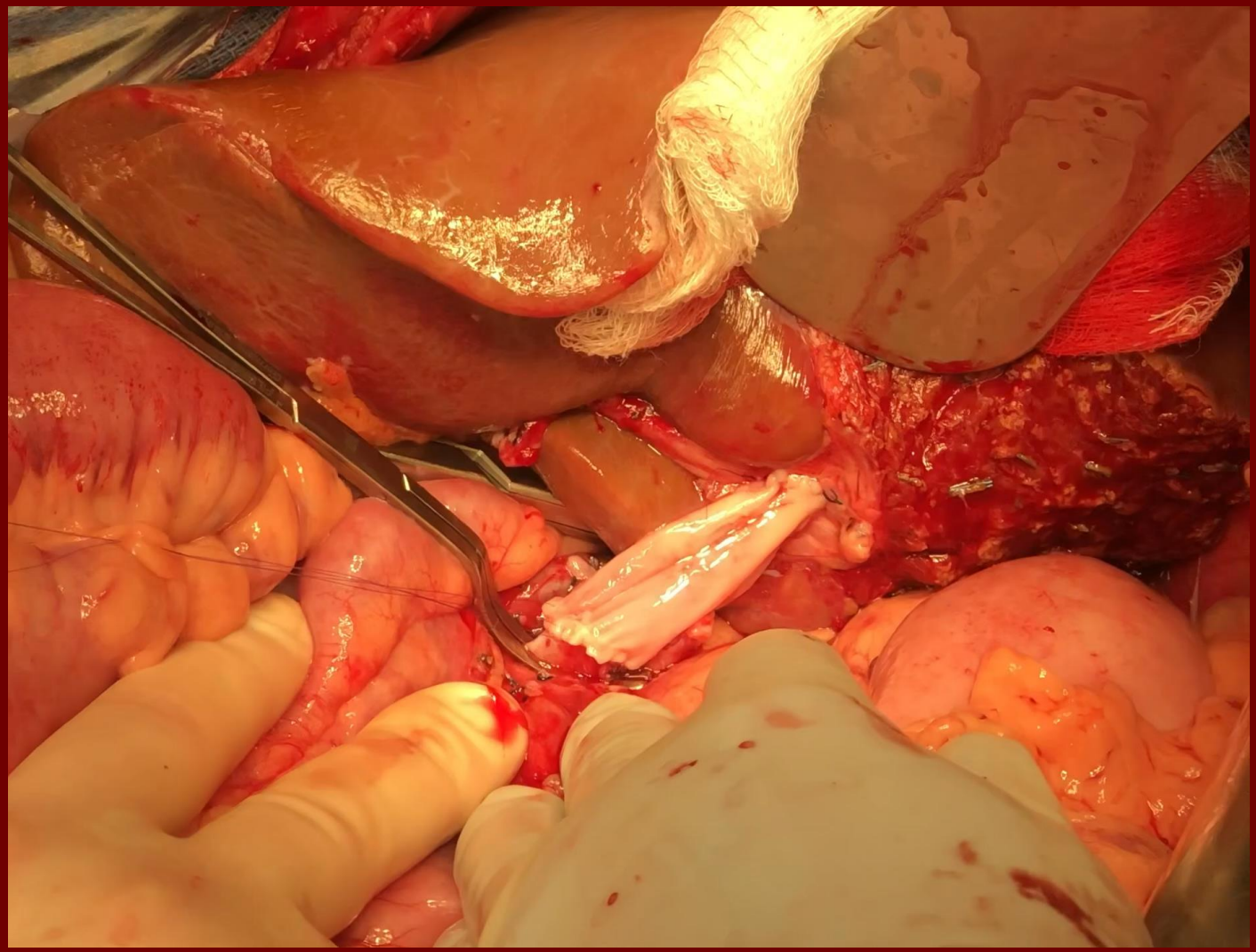
LDLT Recipient – portal inflow



LDLT Recipient – arterial inflow



LDLT Recipient – reperfusion



Post operative care of the donor

ICU monitoring

Pain management

Prophylaxis for DVT and stress peptic ulcers

Monitoring for adequate liver function – LFTs, coagulation panel etc

Donor imaging to look for biliary leak – HIDA scan + US

Most donor labs normalize in 3-6 months

Close outpatient monitoring for at least two years

Donor complications & outcomes – A2ALL

Bacterial infections 12.5%

Biliary leak 9.7%

Incisional hernias 6%

Residual disability, liver failure, death (0.2-0.4%) 1%

Psychological difficulties 4.1%

Financial concerns in 75%, including donation related medical in 37%

90% felt optimistic about donation in long term follow ups

American Journal of Transplantation 2005; 5: 1141–1145
Blackwell Munksgaard

doi: 10.1111/j.1600-6143.2005.00810.x

Brief Communication

To Do or Not to Do Living Donor Hepatectomy in Jehovah's Witnesses: Single Institution Experience of the First 13 Resections

Table 1: Demographic data of the of living donors

Patient	Age	Sex	Relationship to recipient	Portion of the liver procured	% liver removed	Real weight of liver (g)	Time of recipient follow-up (days)
1	24	F	Mother	LLS	18	278	1877
2	45	F	Grand Mother	LLS	14	175	1382
3	33	M	Father	LLS	22	305	1281
4	29	F	Mother	LLS	17	265	247
5	57	F	Mother	RL	67	775	1911
6	26	M	Half Brother	RL	63	1120	1496
7	18	M	Son	RL	65	950	1414
8	53	M	Friend	RL	60	820	1297
9	44	F	Wife	RL	62	900	1290
10	42	M	Son	RL	65	965	1194
11	21	M	Son	RL	61	920	1112
12	49	M	Father	RL	62	805	323
13	41	F	Friend	RL	59	935	261
Mean	*37*						*1160.38*

M = male; F = female; LLS = left lateral segment; RL = right lobe.

Donor Incentivization

TEAM EFFORT

Thank You

Session Survey

Kambiz Etesami, MD | April 20th 8:00 AM-8:45 AM