

Expanding the pool:

Impact of Living Donor and Split Liver Transplantation

Kyoto Japan June 9 2004

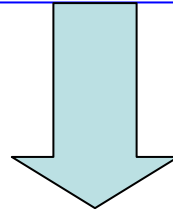
Living Donor Liver Transplantation for Fulminant Hepatic Failure

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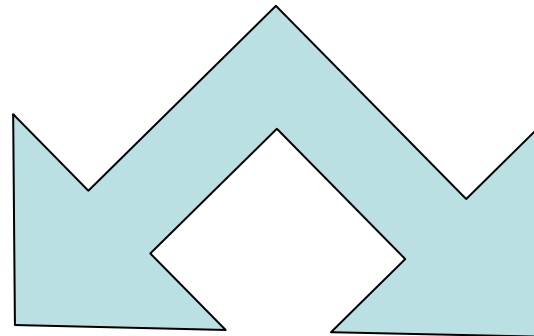
Liver Transplantation for FHF

- FHF is rapidly progressive and irreversible
- Need for liver transplantation is urgent
- It is difficult to obtain grafts in a timely manner from cadaveric donors
- The death rate of patient awaiting for liver transplantation is as high as 40% or 62%.

>80% mortality
in the absence of liver transplantation



Rare cadaveric donors in Asia



Almost hopeless wait

Living Donor
Liver Transplantation

Living-related Liver Transplantation in FHF

Matsunami et al. Lancet 1992;340:1411

- 15-year-old boy of 48 kg
- Acute liver failure by drug reaction
- Left lobe graft from his father
- 51% of SLV

LDLT for FHF

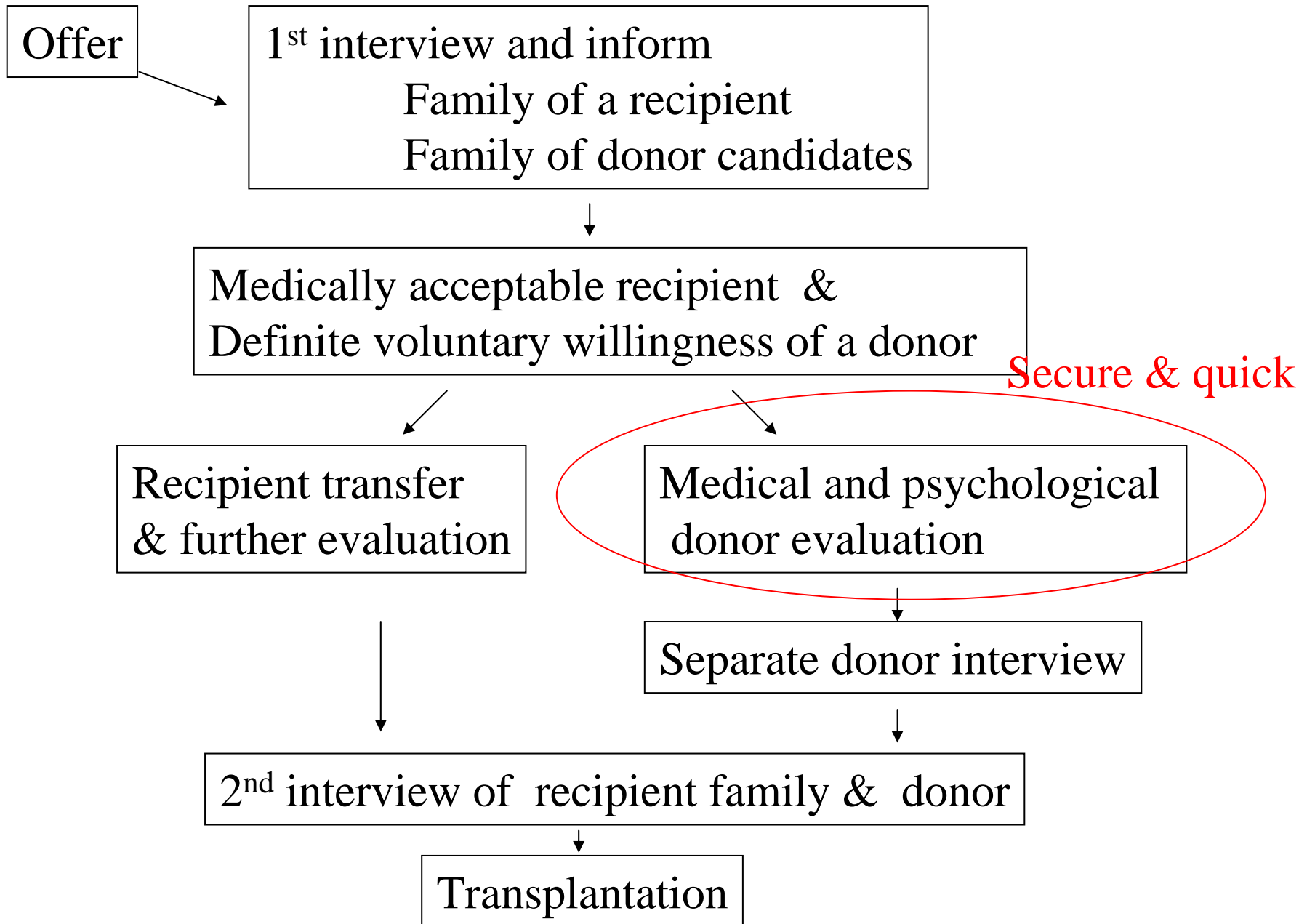
Advantage

- Availability of graft
 - short waiting time
 - timely transplantation
- Good quality of a graft from a healthy donor

LDLT for FHF

Disadvantage

- Short time to decide the donation
- Short time to evaluate donor candidates
- Donor complications
- Complex surgery
- Recipient complications
- Possible small for size graft



Urgent Living-Donor Evaluation

Medical

Physical ex. &
laboratory data

Blood type (30min)

CBC, coagulation, chemistry (30min)

Infection (2hr) HLA (2hr)

Occult blood of stool, Urine analysis (5min)

Radiology

Abdominal & chest X-p (5min)

US screening (20 min)

CT scan (15min)

Check steatosis &
Anatomy &
Volumetry

1hr

Cardio-pulmonary
function check

ECG, UCG, spirometry

Psychological

Interview by psychiatrist

Decision

Non-alcoholic Steato-hepatitis

No alcoholic history

No other etiology

Risk factors

diabetes, hyperlipidemia, obesity, hypertension

Symptoms

no specific symptoms and liver failure with cirrhosis

Physical signs

hepatomegaly

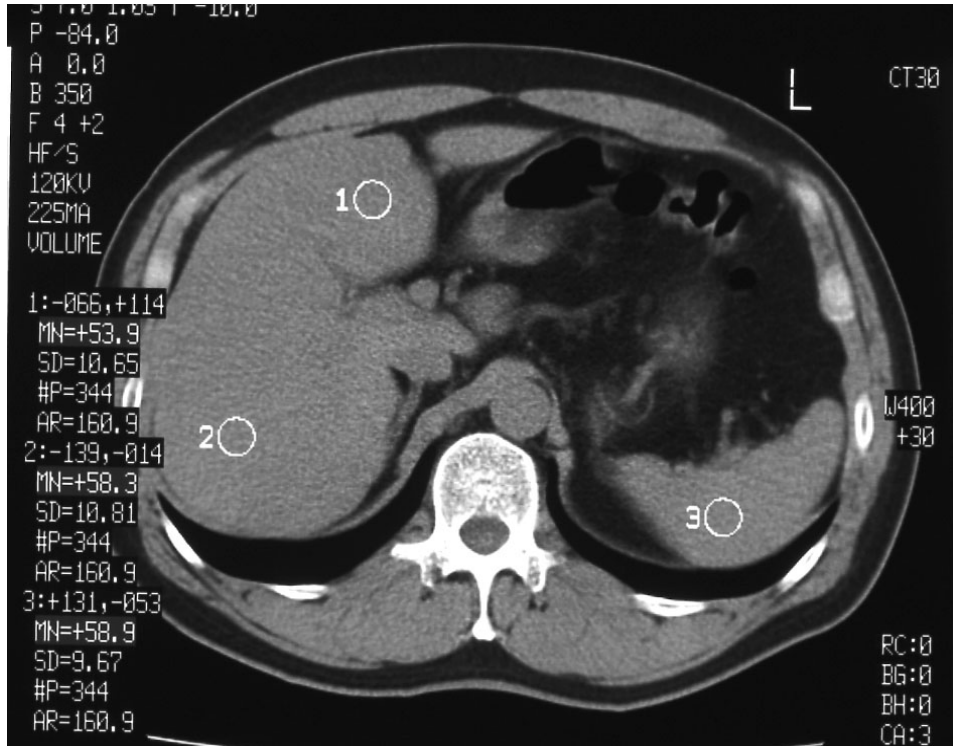
Pathology

steatosis and fibrosis

Incidence

unknown in Japan, increasing

Preoperative Assessment of Steatosis with CT Scan



Liver / Spleen ratio of
CT value

$$\#1 / \#3: 53.9 / 58.9 = 0.91$$

$$\#2 / \#3 : 58.3 / 58.9 = 0.98$$

Safety value > 1.2

Marginal value $1.0-1.2$

Risky value < 1.0

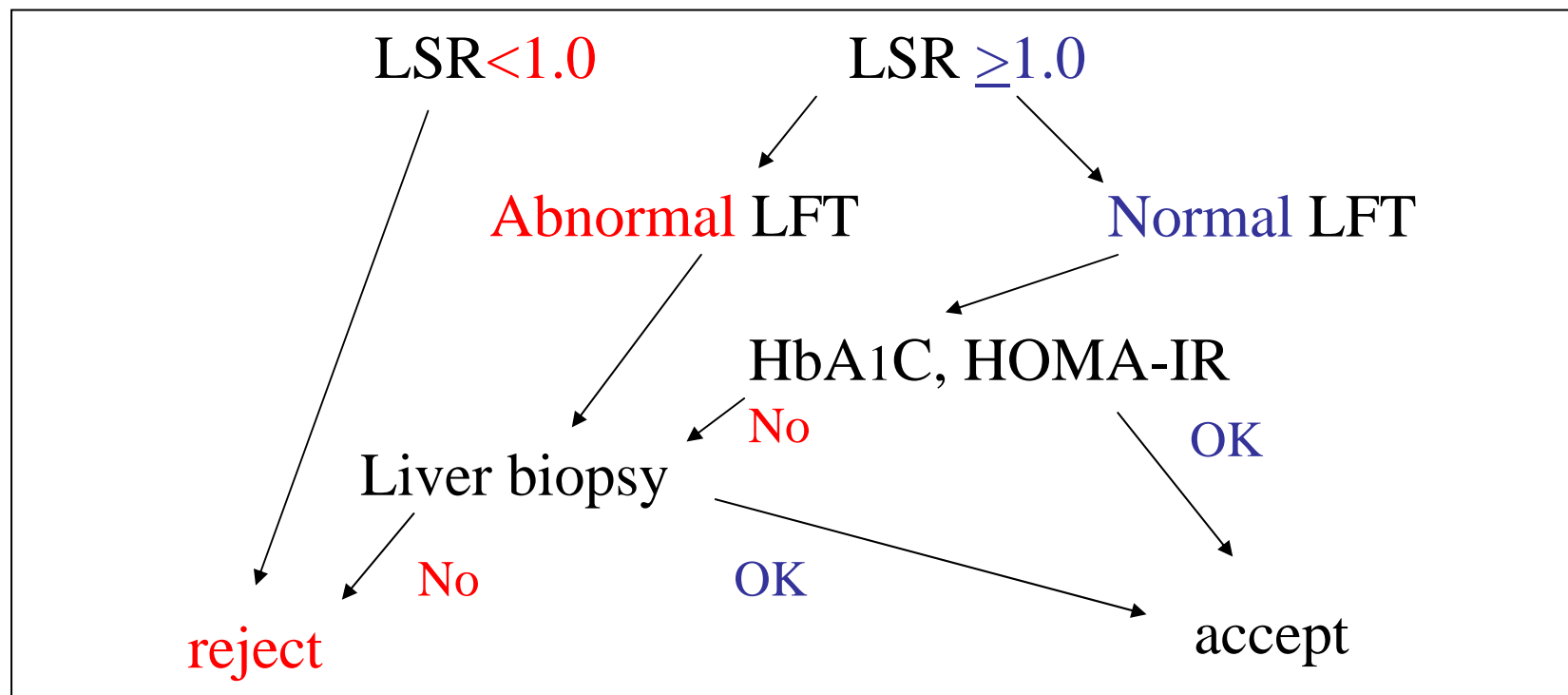
Steatosis \gg excise, diet \gg re-assessment

But, how should we do in an urgent case ?

Strategy for Possible Steatosis in an Urgent Case

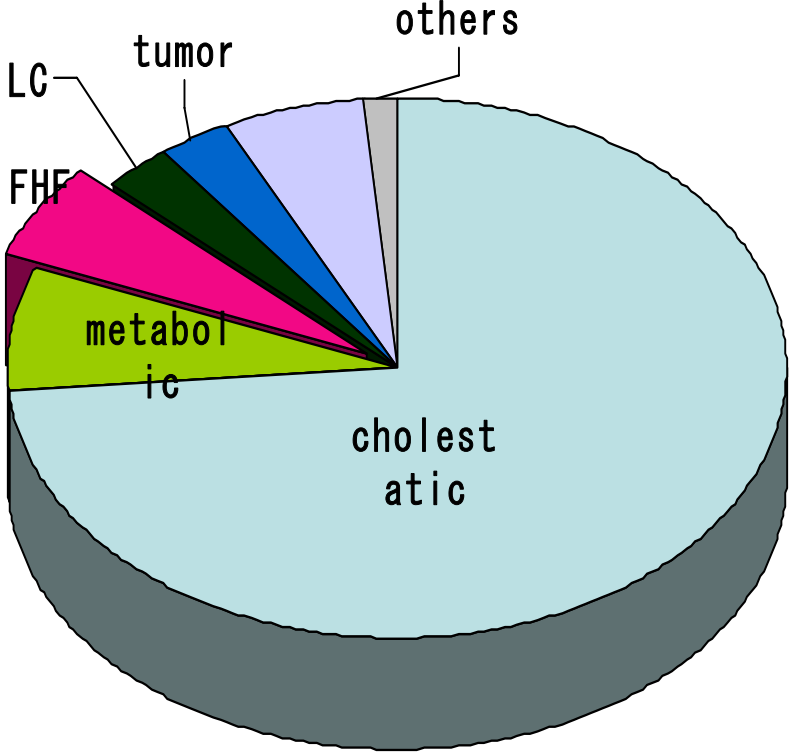
- High risk donor: alcohol, BMI >28
- Suspected by radiology: US, CT

Evaluation by CT density: liver / spleen ratio (LSR)

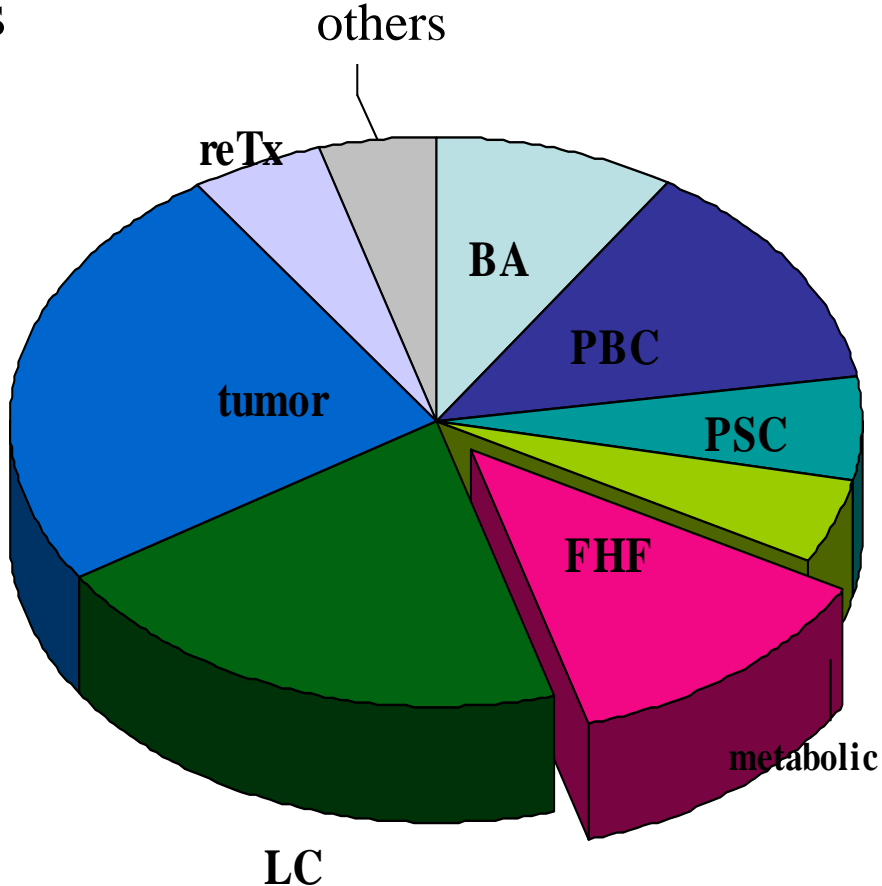


Indication for Living Donor Liver Transplantation in Kyoto

82 cases

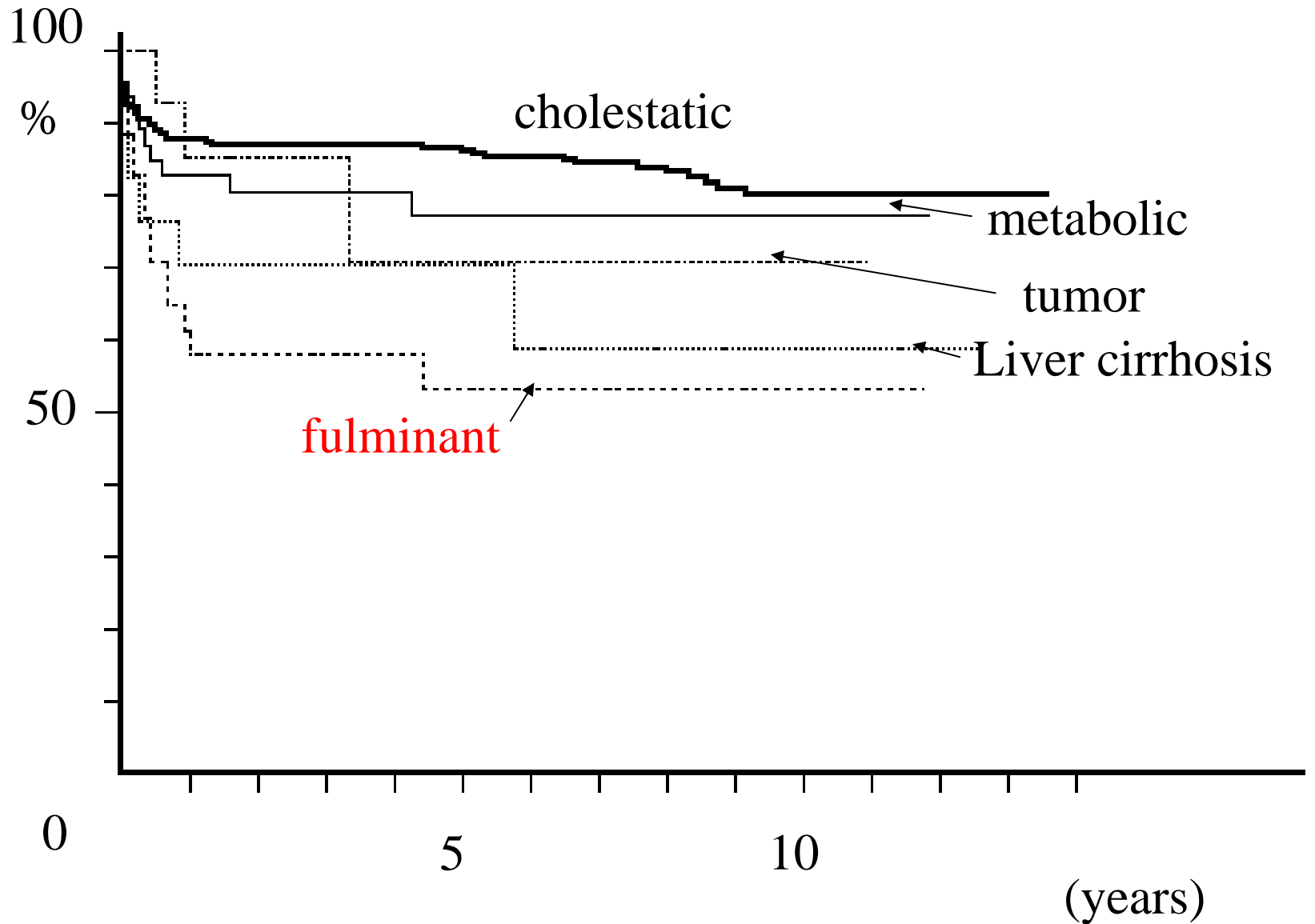


Pediatric

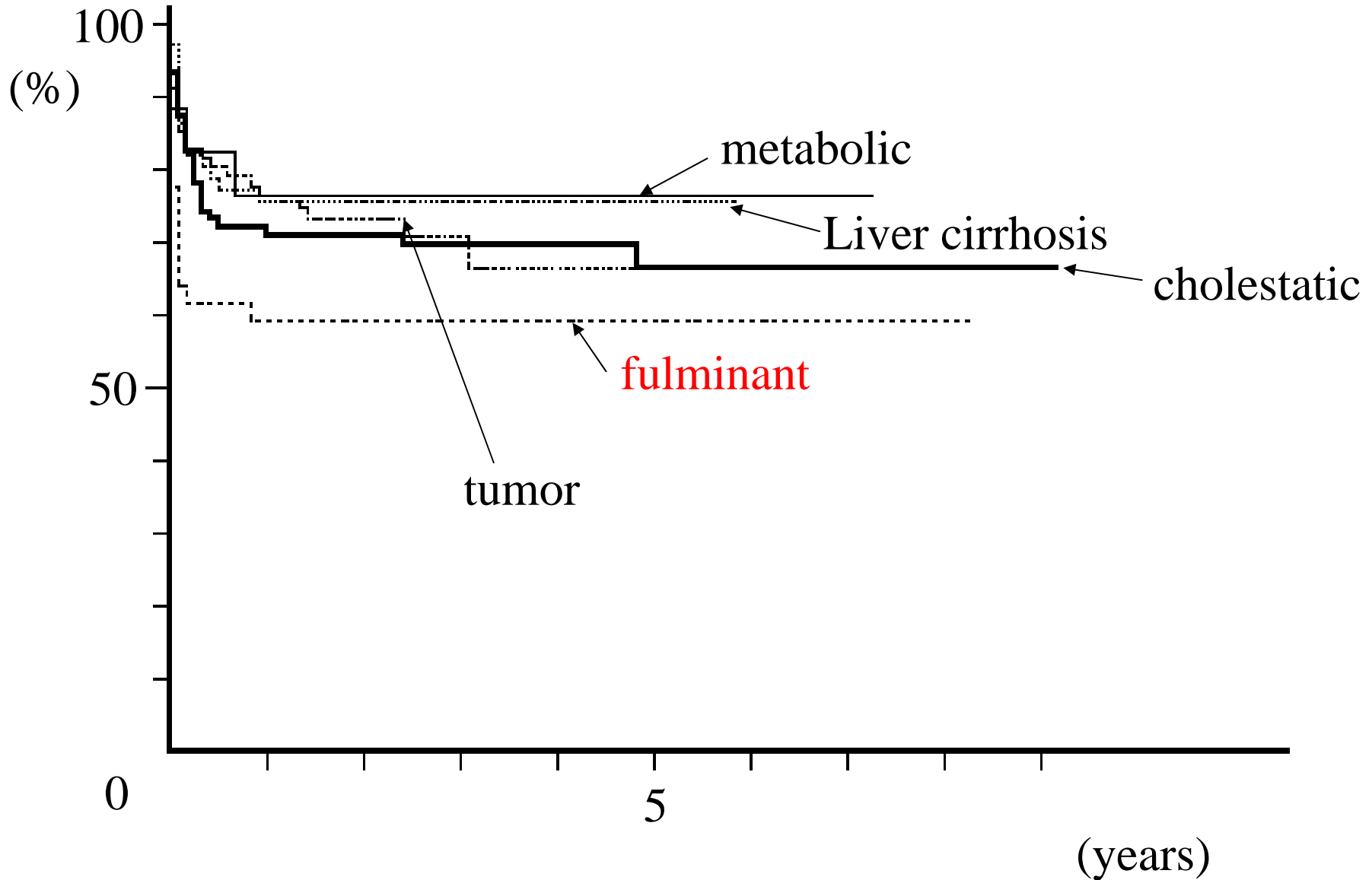


Adult

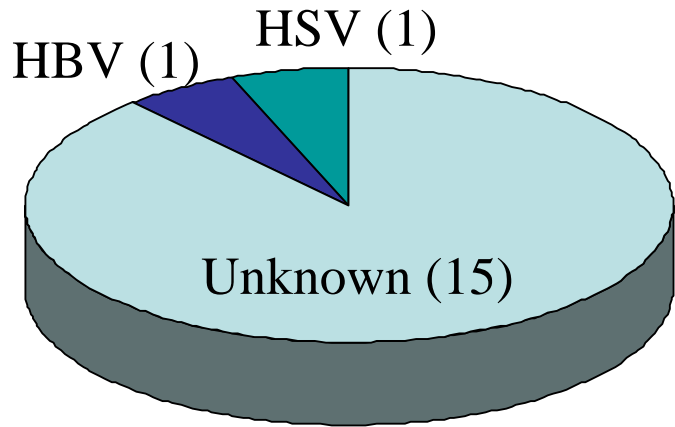
Indication and Patient Survival in Children



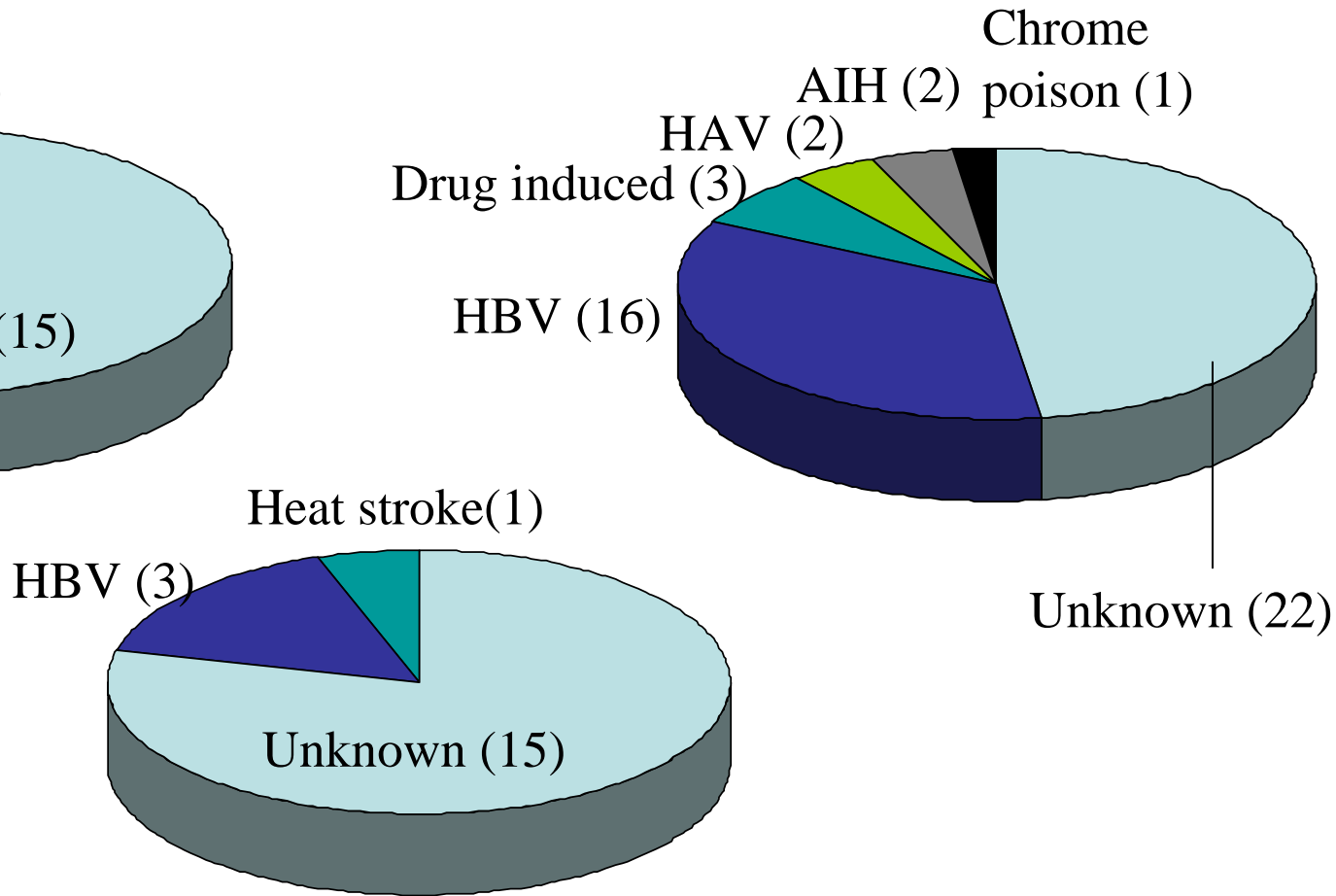
Indication and Patient Survival in Adults



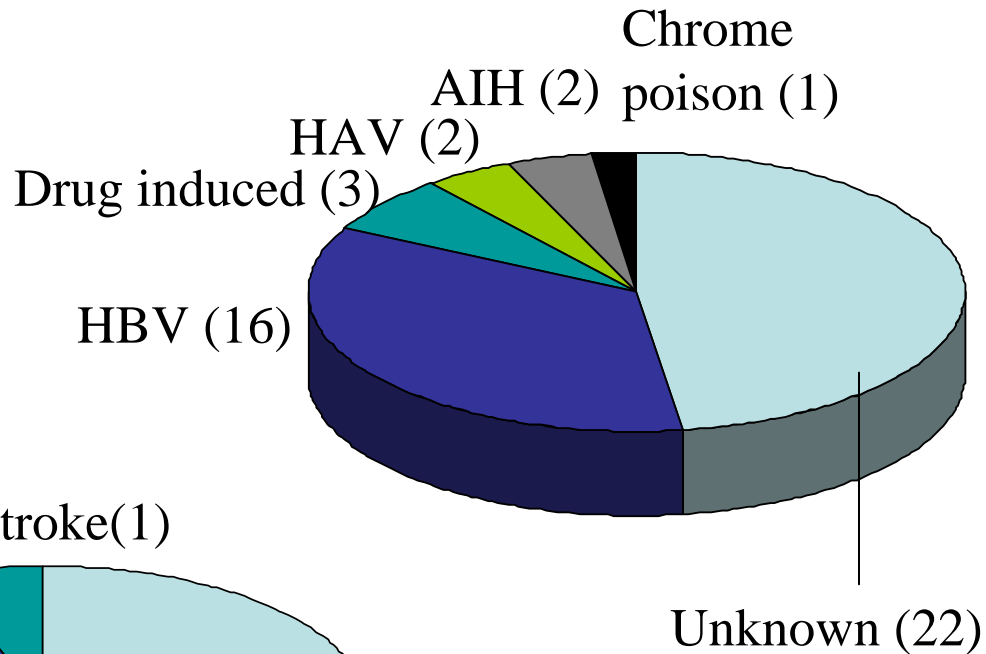
Etiology of FHF



<1 y.o.



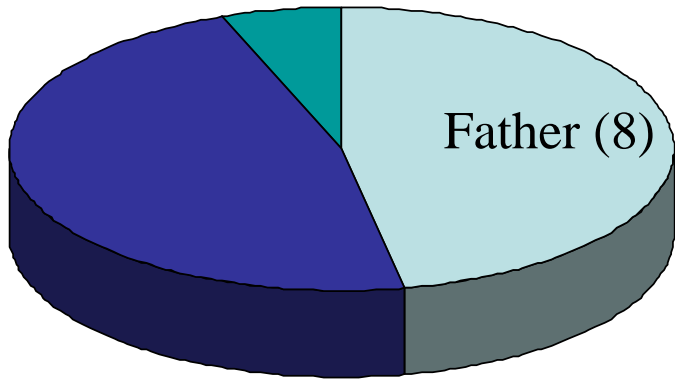
1~18 y.o.



≥18 y.o.

Donor

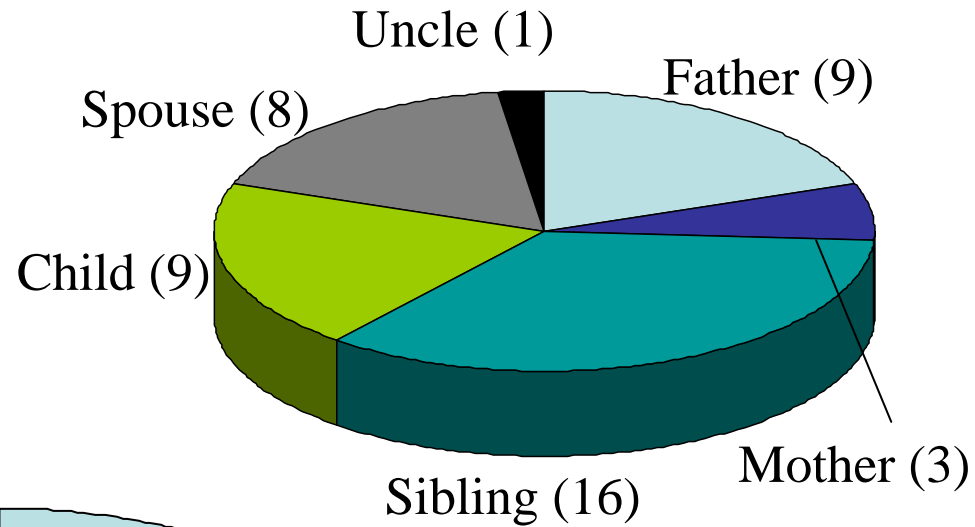
Ground mother (1)



Mother (8)

Mother (8)

<1 y.o.



Uncle (1)

Spouse (8)

Child (9)

Sibling (16)

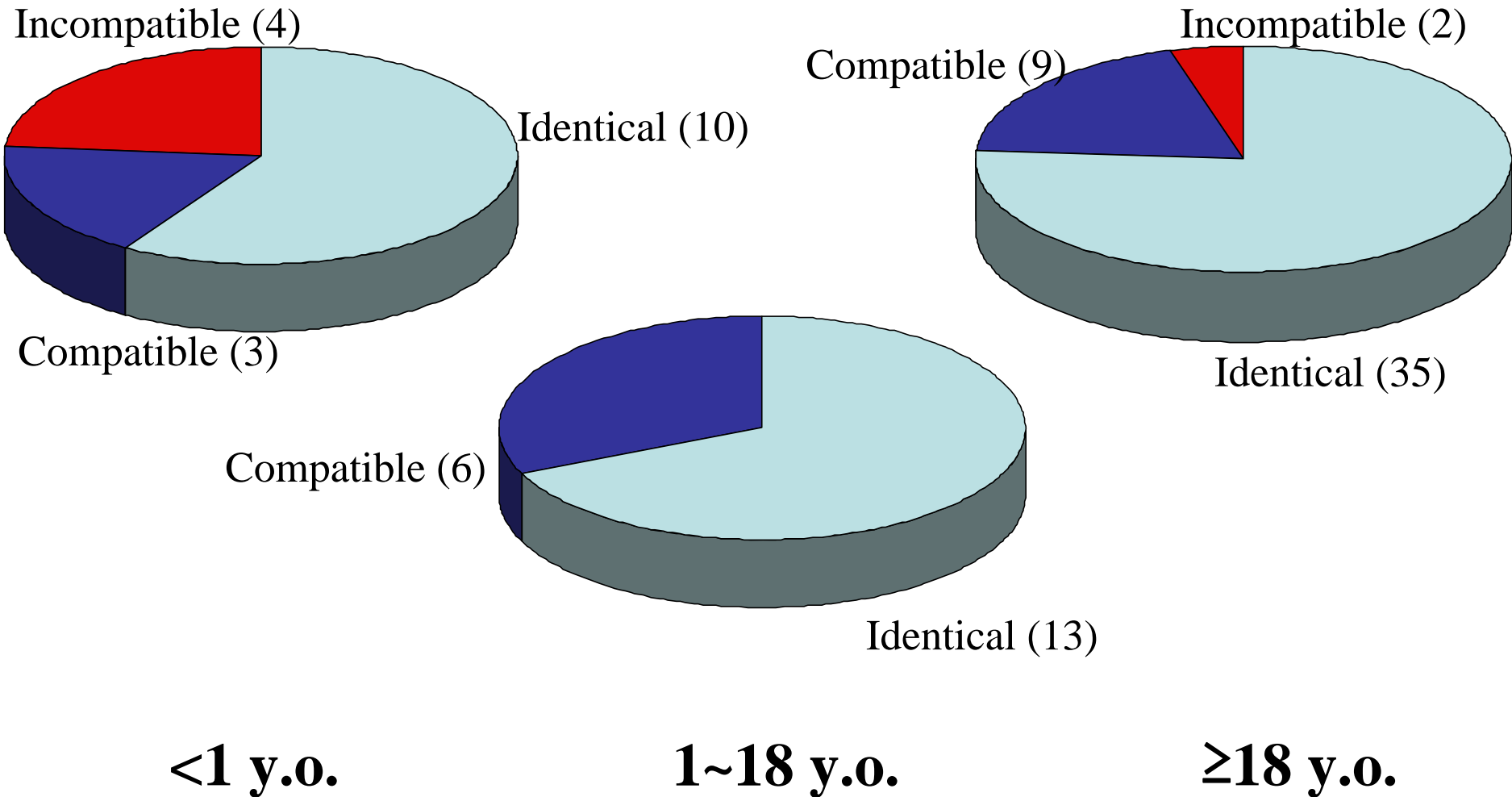
Mother (3)

1~18 y.o.

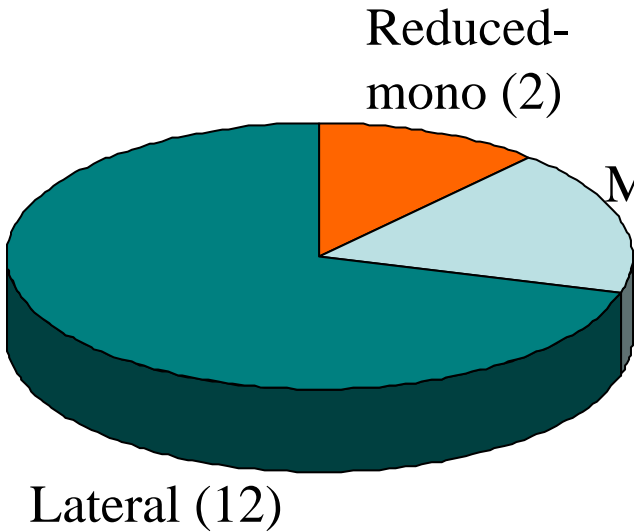
≥18 y.o.

Father (8)

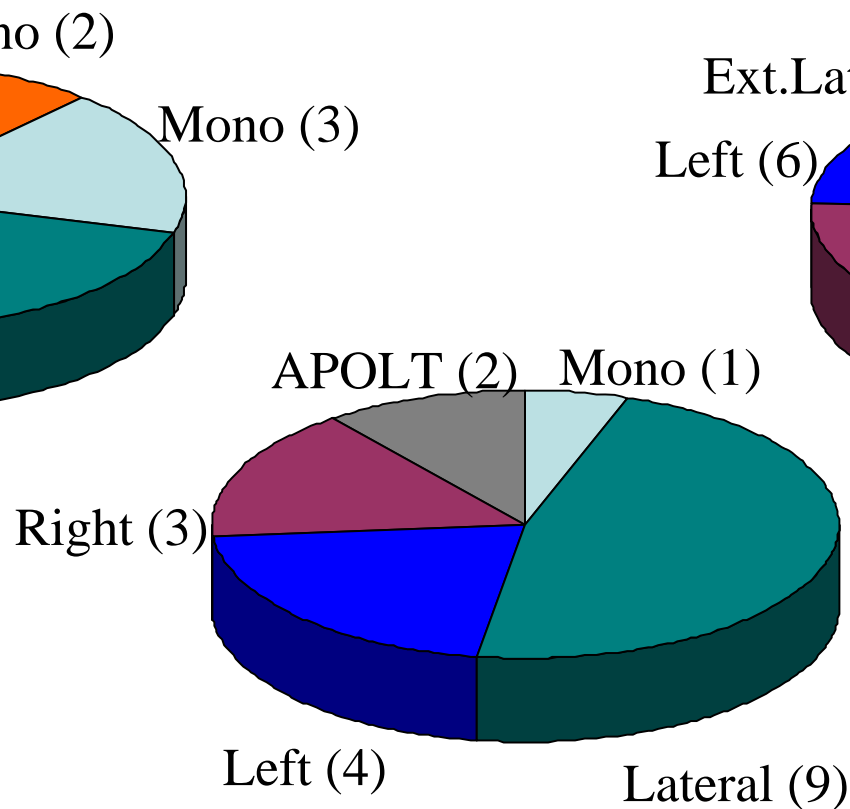
Blood Type Combination



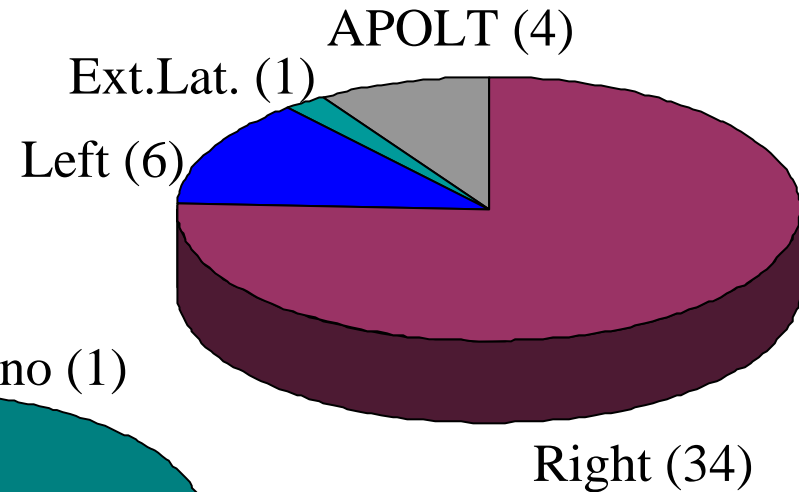
Graft Type



<1 y.o.

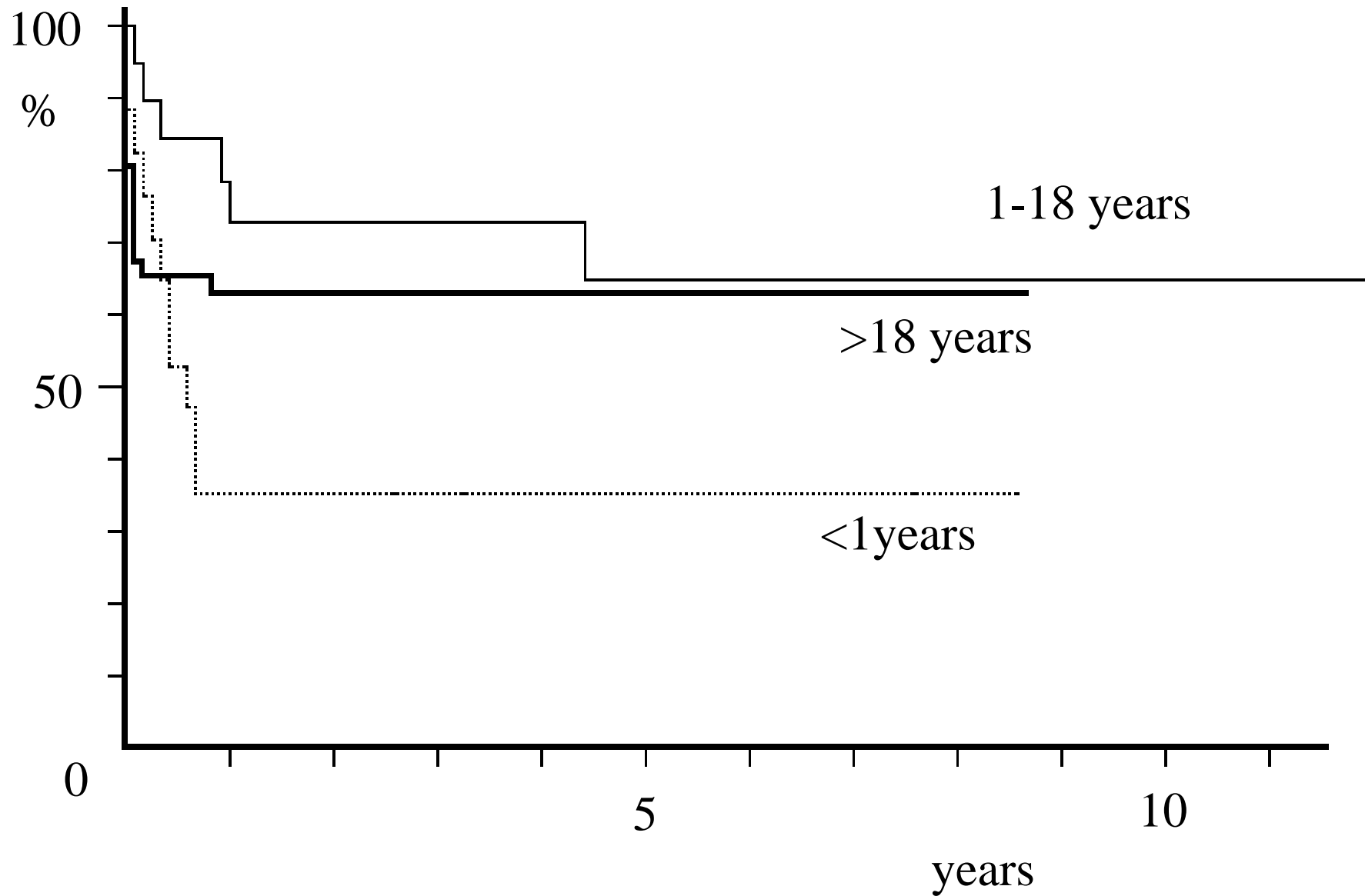


1~18 y.o.



≥18 y.o.

Recipient Age and Patient Survival



Impact of Recipient Age

- Inferior outcomes of the less-than-1-year-old children
 - Farmer DG, et al. Ann Surg 2003;237:666
 - Bonatti H, et al. Transplant Proc 1997;29:434
 - Noujaim HM, et al. J Pediatr Surg 2002;37:159

Technical difficulty → Vascular thrombosis

Rash deterioration → Sepsis
Donor scarcity → Haemorrhage
MOF

but

Low incidence of ACR

LDLT for FHF in Children

Lie CL et al. Liver Transplantation 2003;9:1185

- 8 patients (Age: 3 mo-11 years)
- Etiology: drug induced (2), idiopathic (6)
- Outcomes
 - 3 death in patients with idiopathic etiology
 - Causes of death
 - Recurrence of acute hepatitis in the 3 months old child
 - Refractory rejection in the 8 months old child

Result of LDLT for FHF in Children <1y.o. -Kyoto Experience-

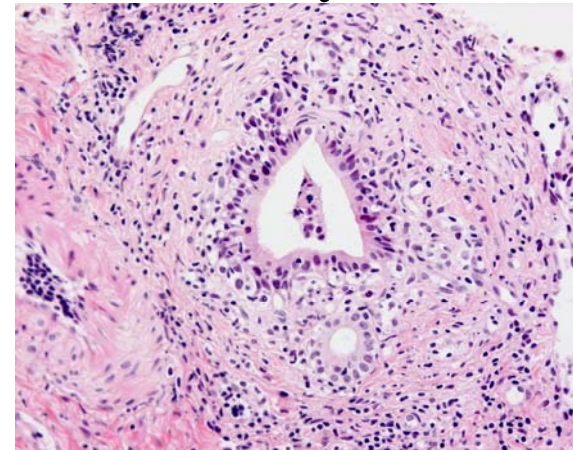
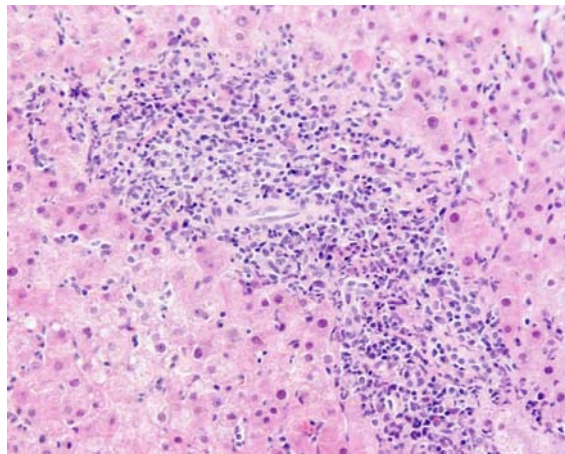
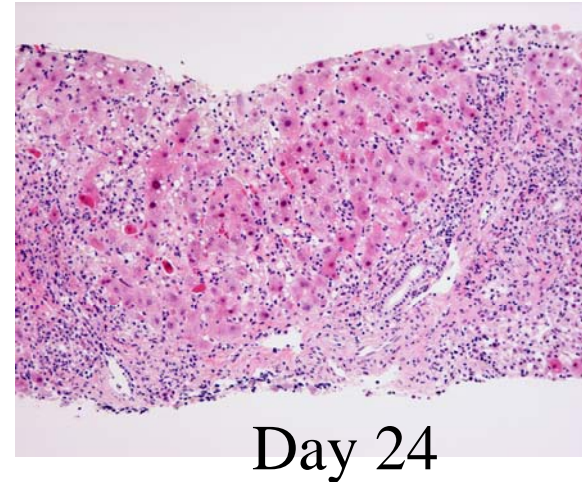
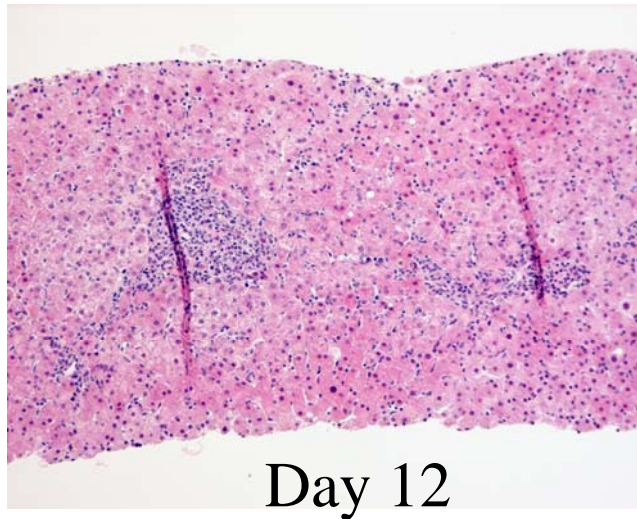
Etiology	outcome	Causes of death
HBV(1)	alive	
HSV(1)	alive	
unknown(15)	alive (4) (normal LFT [1] and waiting for re-Tx [2]) dead (11)	recurrent hepatitis (5) refractory ACR (1) chronic rejection (1) EBV hepatitis (1) MOF after Rota-virus infection (2) HAT (1)

Result of LDLT for FHF in Children <1y.o. -Kyoto Experience-

Etiology	Biopsy findings
HBV (1)	no biopsy
HSV (1)	no biopsy
unknown (15)	moderate ACR (4) severe ACR (7) chronic rejection (1) hepatitis (7) massive necrosis (4)

A Case of FHF

5 months old girl, 7.8 kg, unknown etiology
Donor: mother, identical blood type



moderate ACR with lobula
inflammation

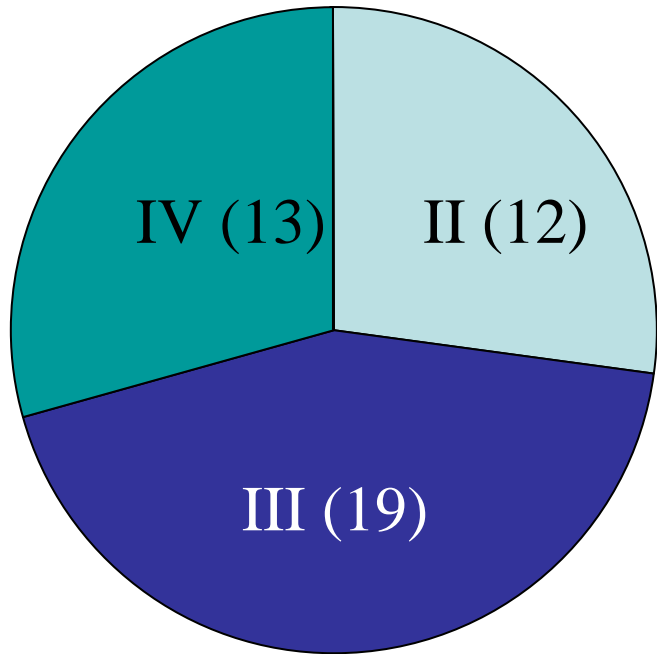
severe ACR with hepatocyte dropout,
simulating “recurrent fulminant hepatitis

LDLT for FHF with unknown etiology in Children <1y.o.

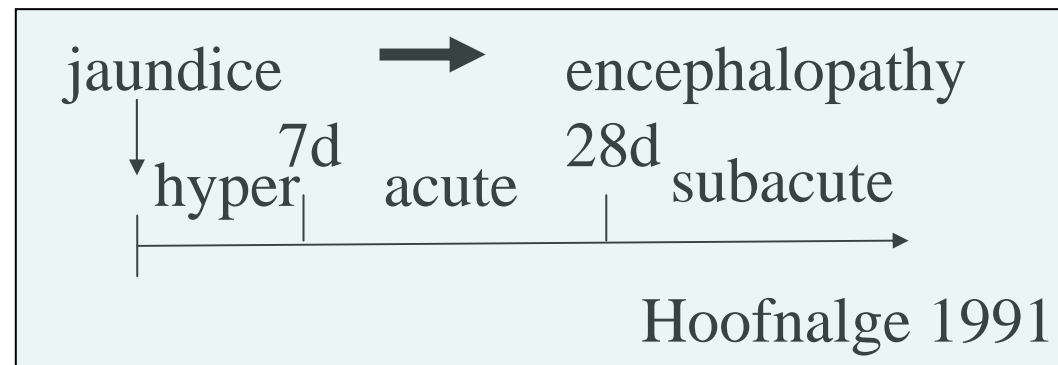
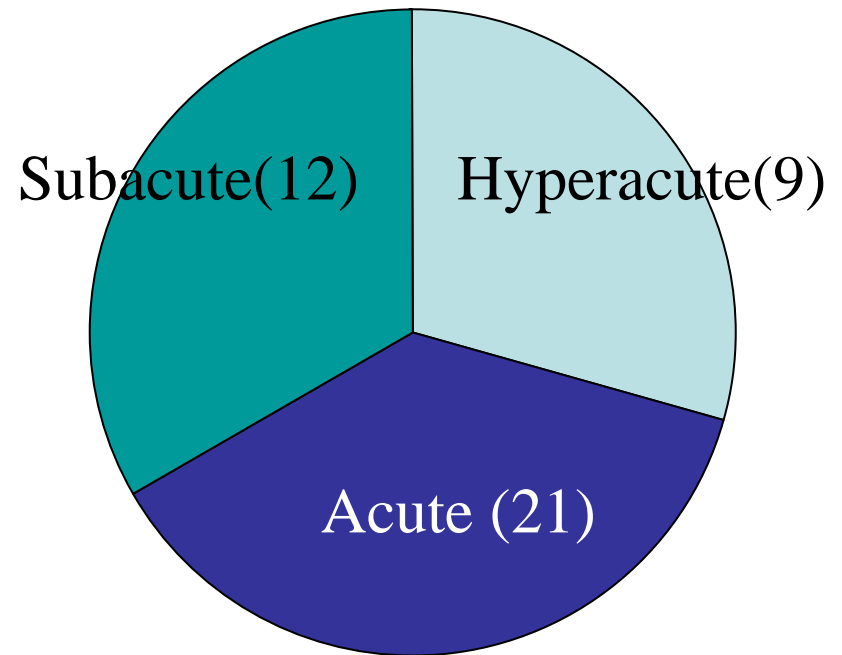
- Poor outcomes
- Strong immunosuppression is required
- No strategy for recurrent hepatitis

LDLT for FHF in Kyoto

Coma grade **Adult cases**



Type



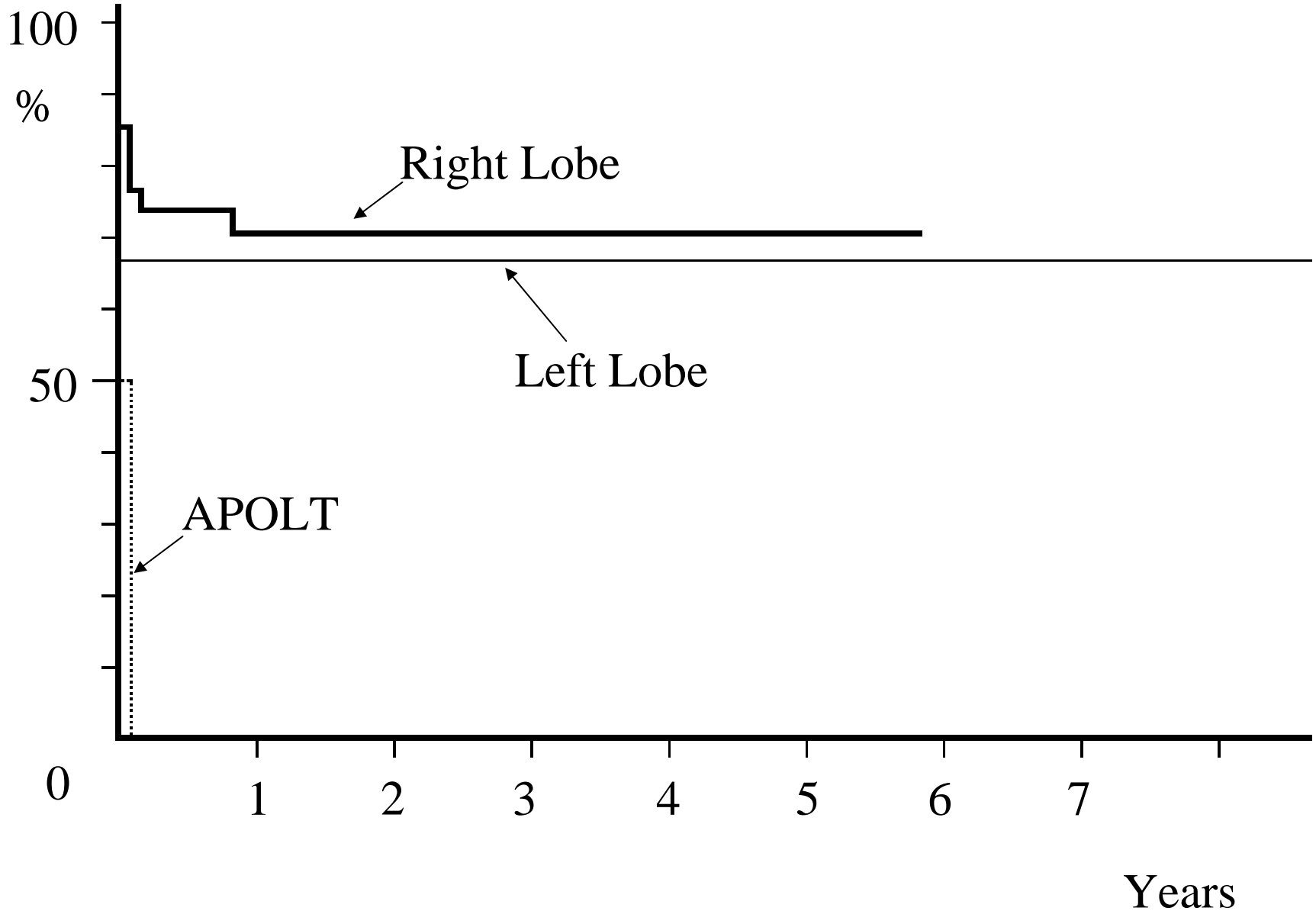
Neurological Death after LDLT

- Reported incidence: 4 ~ 11%
- Kyoto Experience
 - Incidence: 5%
 - All adult patients
 - GBWR: 0.73 ~ 1.24%
 - Preoperative coma grade: III (1), IV (3)

How much volume do we need for adult patients with FHF?

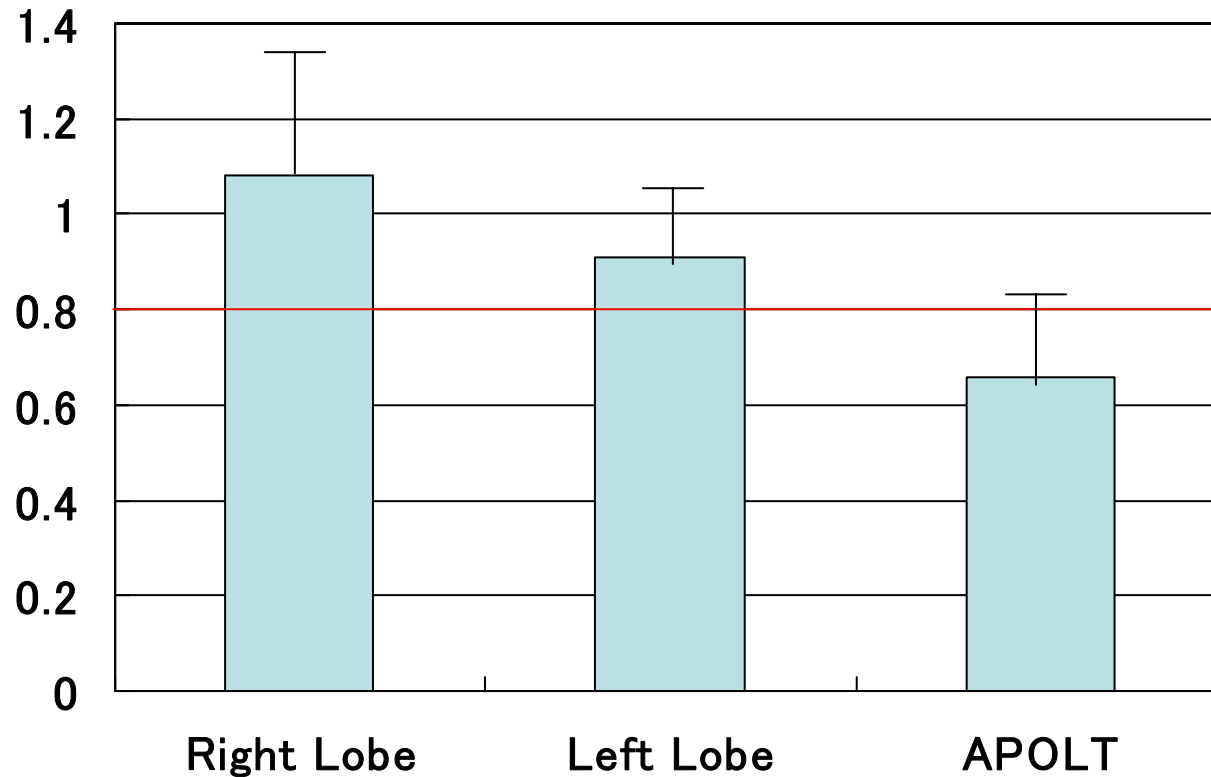
- Left lobe :
 - 23%-54% SLV
 - Nishizaki et al. Surgery 2002;131:182
 - >35%
 - Miwa et al. Hepatology 1999;30:1521
- Right Lobe
 - 40% and more is favorable
 - Liu et al. British J Surgery 2002;89:317
- Right or left or APOLT ?

Graft Type and Patient Survival

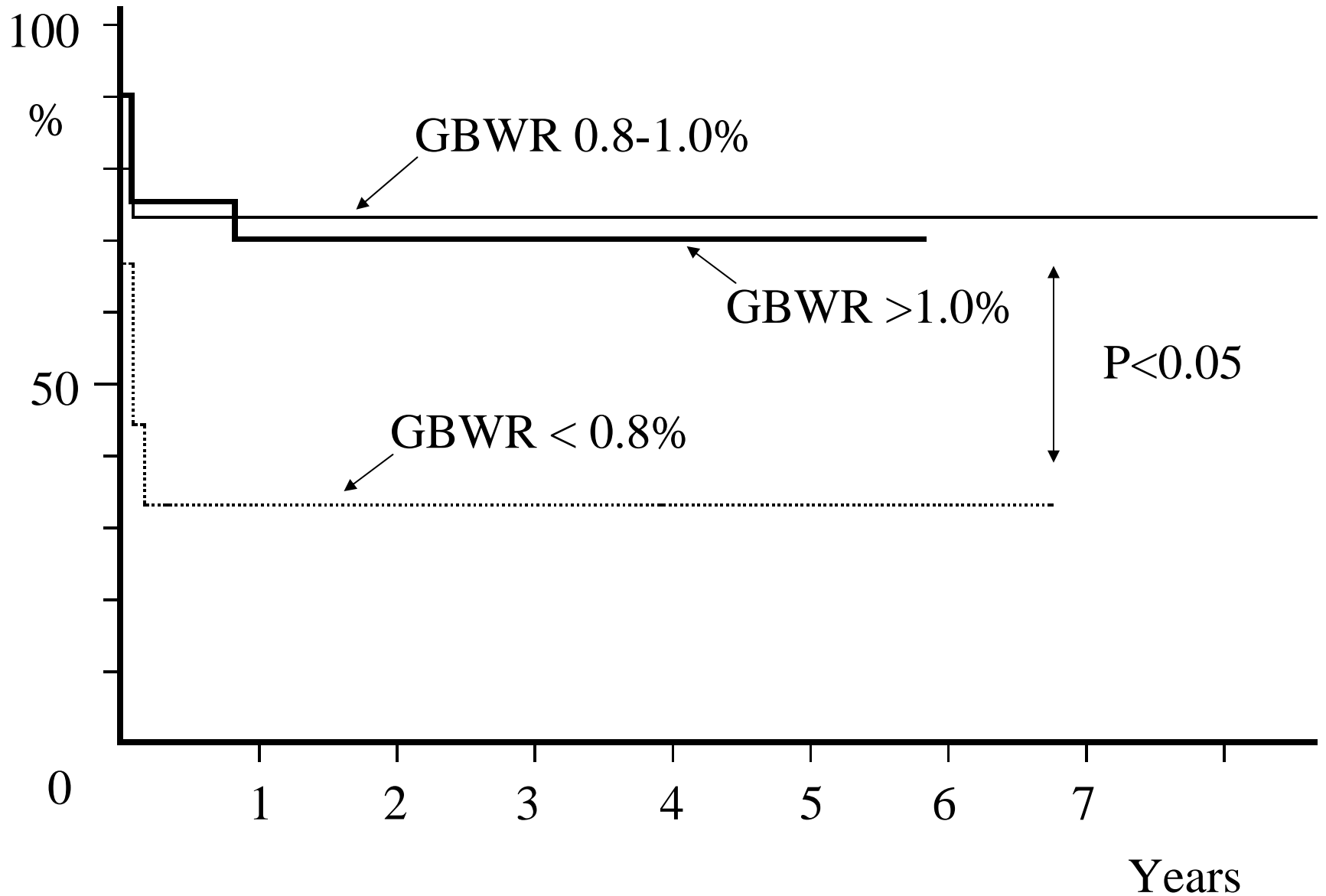


GBWR and Graft Type

GBWR = graft weight/recipient weight x100 (%)



GBWR and Patient Survival



How much volume do we need for adult patients with FHF?

Answer

- There is no difference between left lobe and right lobe when the graft volume is enough.
- The safe limit is GBWR of 0.8.
- Grafts with GBWR of 0.8 should be used even in APOLT .

Risk Factors in Adults

-Kyoto Experience-

- Preoperative factors
 - Other organ dysfunction
 - Renal dysfunction: $Cr_{e} > 2.0$, with dialysis
 - Respiratory dysfunction: on ventilator
 - Pancreatitis
 - Preoperative steroid administration > 20 days
 - MELD ≥ 25 ($p=0.054$)
- Operative factors
 - Small for size: GBWR < 0.8

Small-for-size Syndrome

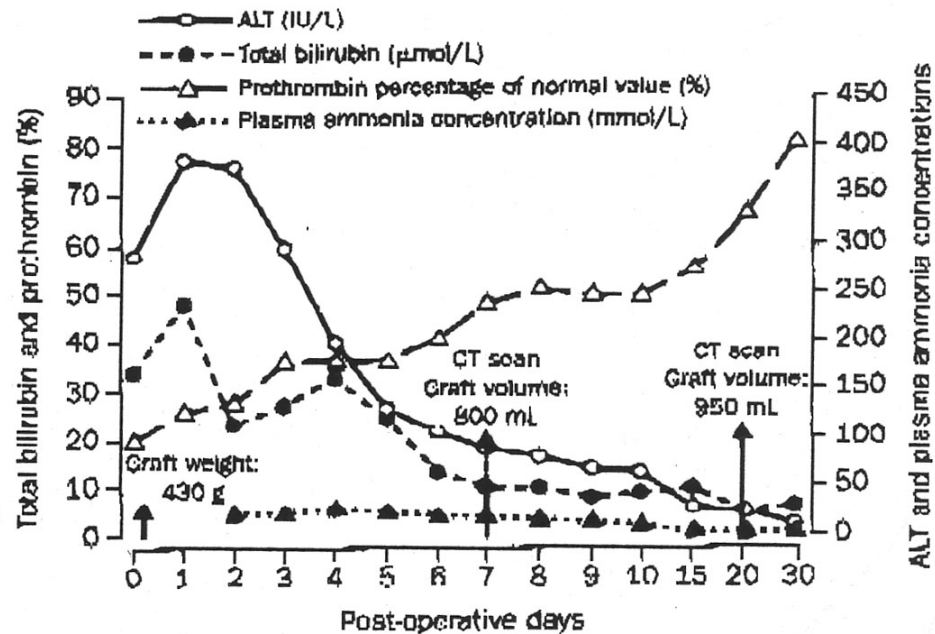
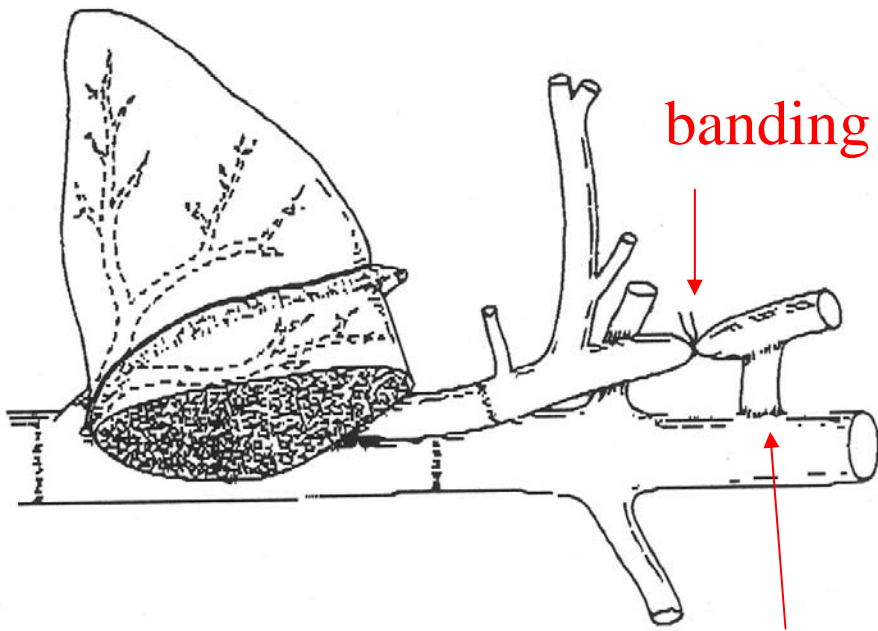
- Prolonged cholestasis
- Coagulopathy
- Massive ascites
- Gastrointestinal bleeding
- Renal dysfunction

Strategy for Small for Size Graft

- Monitoring PV pressure < 20cmH₂O
- Surgery
 - Outflow wide anastomosis
reconstruction of HVs draining to MHV
right lobe graft with MHV
 - Inflow splenic artery ligation
porto-caval shunt

Small-for-size partial liver graft in an adult recipient; a new transplant technique

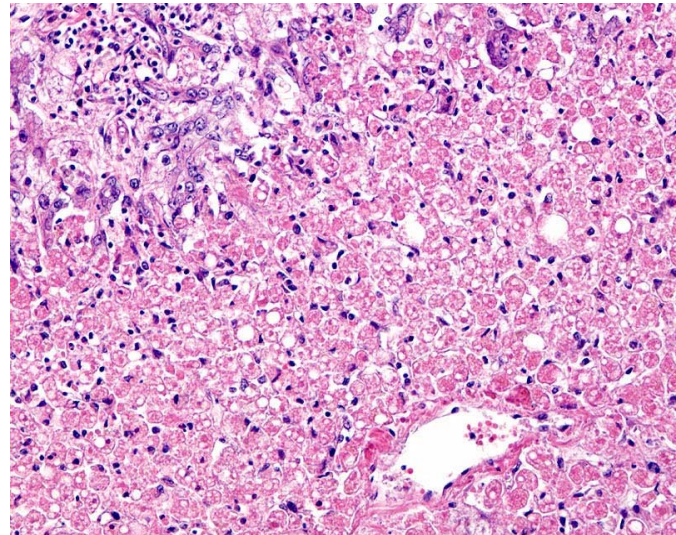
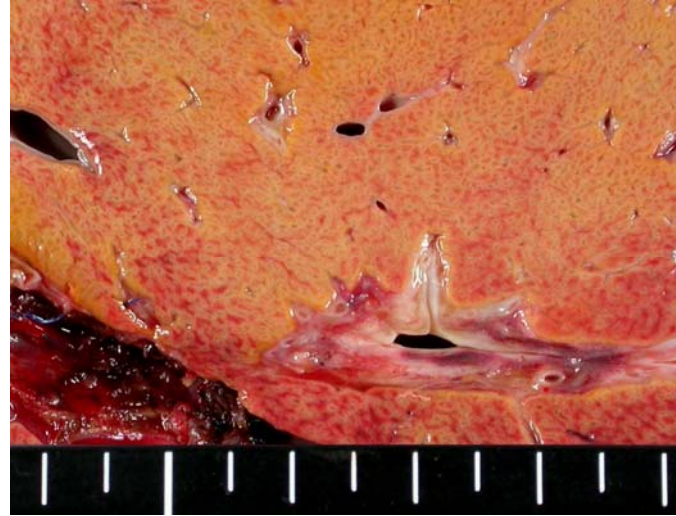
O.Boillot, et.al., The LANCET; vol.359 (2002)



PC shunt

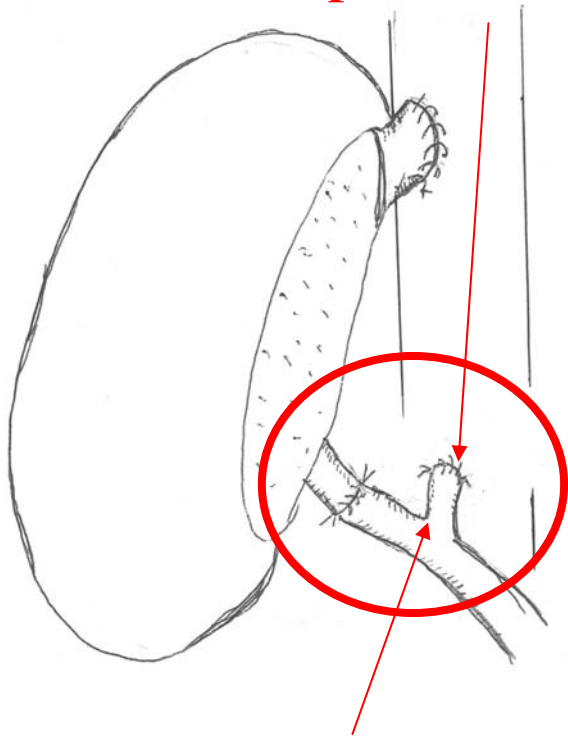
A Case of Heat Stroke

- Recipient
 - 16y.o. boy
 - Heat stroke with liver & kidney failure
 - Come grade IV
 - 79kg in body weight
- Donor
 - Patient's mother
 - 51kg in body weight
- GBWR: **0.62** (496g)



Effect of Inflow Moduration for Small for Size

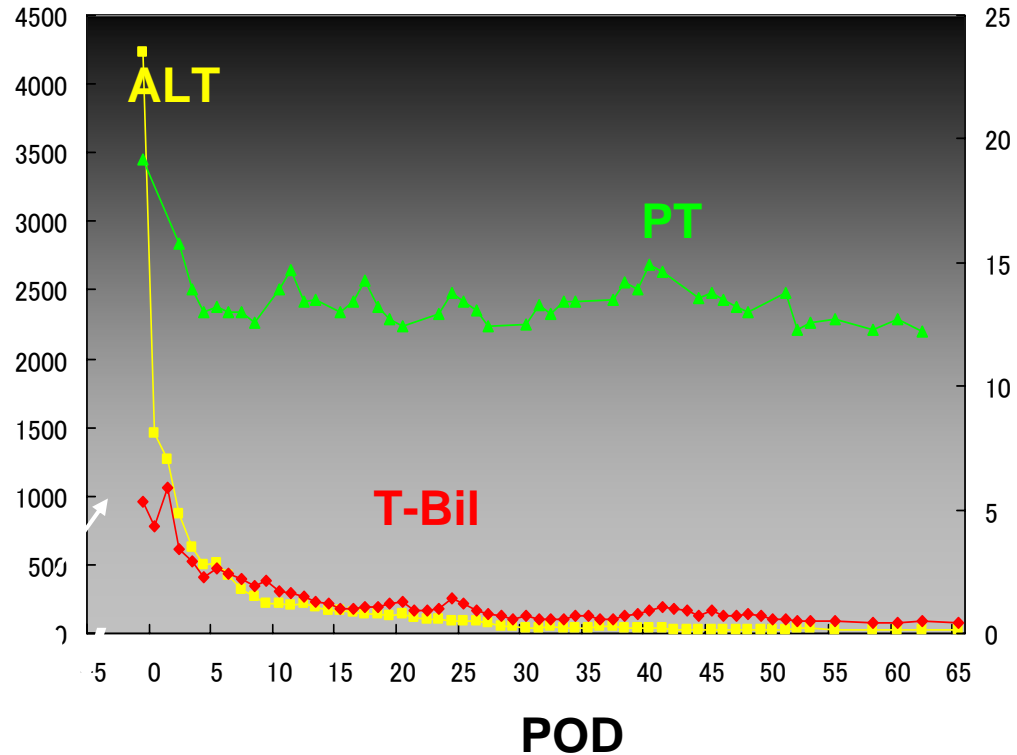
Partial porto-caval shunt



Recipient left PV

ALT

T-Bil, PT(sec)



Musts in LDLT for FHF

- Aim 1: Timely LDLT
 - Offer to LDLT center ASAP
 - Inform family about an option of LDLT ASAP
 - Evaluate donor candidate quickly
- Aim 2: Donor safety & ethics
 - Inform donor risks as well as recipient benefits
 - Do not rush donor candidates to decide organ donation
 - Evaluate donor candidate without omission
 - Secure residual liver volume $\geq 30\%$
- Aim 3: Enough graft & residual liver volume
 - Choose graft type with GBWR > 0.8
 - Choose appropriate procedures in case of small for size graft

Donor Evaluation in LDLT for FHF

