Living Donor Liver Transplantation

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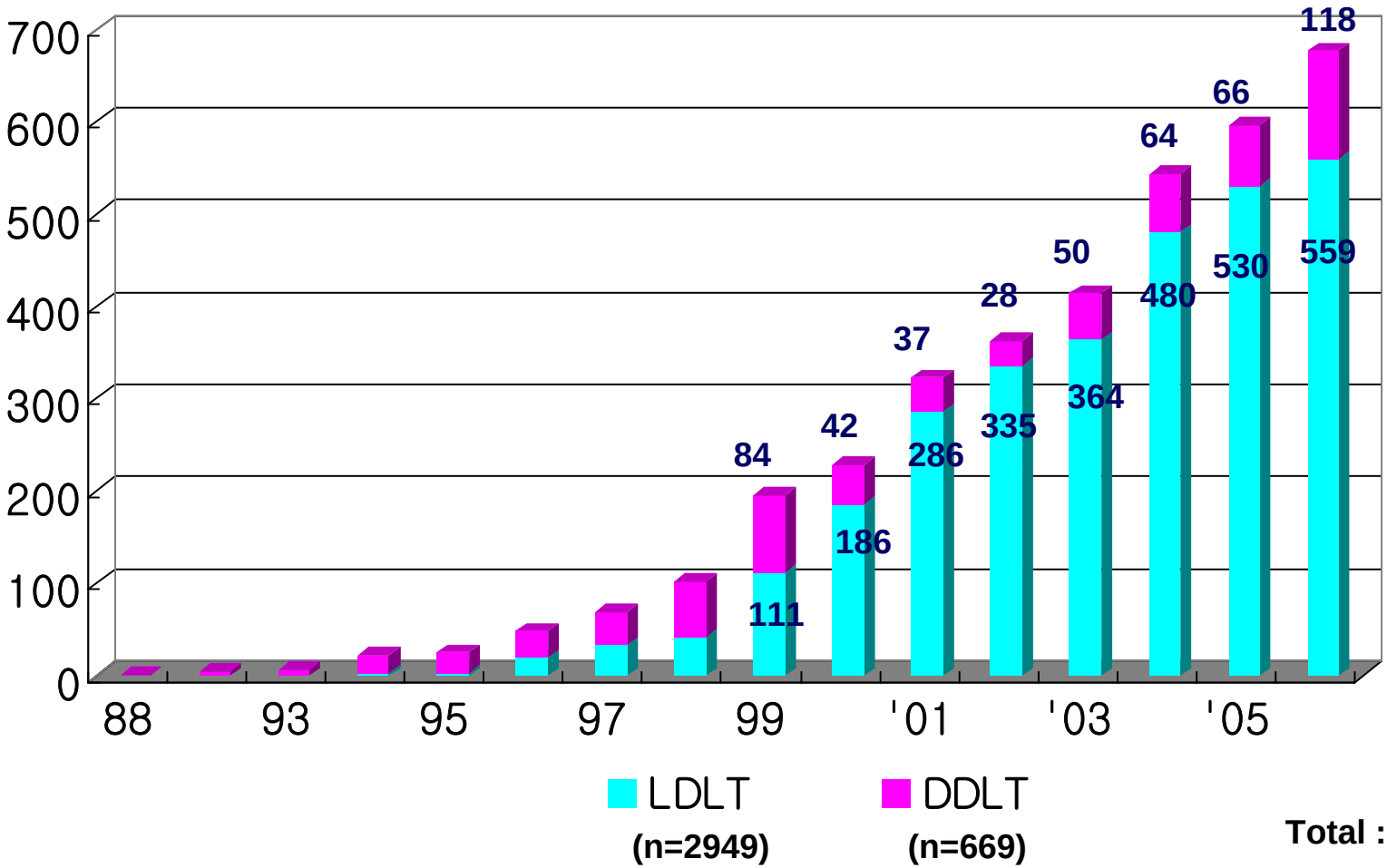
Liver Transplantation in Korea



Total : 3618

Today's topic

- **MHV reconstruction**
- **Outcome of 300 live donors**
- **Small-for-size graft**
- **LDLT for HCC**

Anatomical Consideration in Donor Hepatectomy

INFLOW	=	OUTFLOW
(portal v. hepatic a) bile duct		(hepatic v.)

in both donor and recipient

- Inflow > Outflow → Congestion
- Outflow > Inflow → Ischemia

Original Paper

Technical Refinement Preserving Segment 4 to Donor in Extended Right Hepatectomy

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ABSTRACT

Background/Aims: Donor extended right hepatectomy, including the middle hepatic vein (MHV) and a part of segment 4 (Sg4), is performed to overcome inadequate graft for large adult recipient as resolving congestion of right anterior section. However, using this technique remnant donor liver is often too small. Here, we introduce a technical Modified extended right hepatectomy (MERH), in which the MHV was excavated preserving the entire Sg4 in the donor.

Methodology: We compared clinical outcomes between donors using our technique (n=12) that may result in Sg4 congestion, and right hepatectomy (RH, n=12) that may not. MERH was performed when the remnant donor liver had a volume exceeding 35% and showed no steatosis in preoperative imaging study.

Results: No donor died, and there were no differences in operative time and postoperative recovery between the two groups ($p>0.05$). The regeneration of the remnant liver after MERH and RH were similar (160.2% *vs.* 187.7% at POD 10; 222.2% *vs.* 230.5% at 4 months) ($p>0.05$).

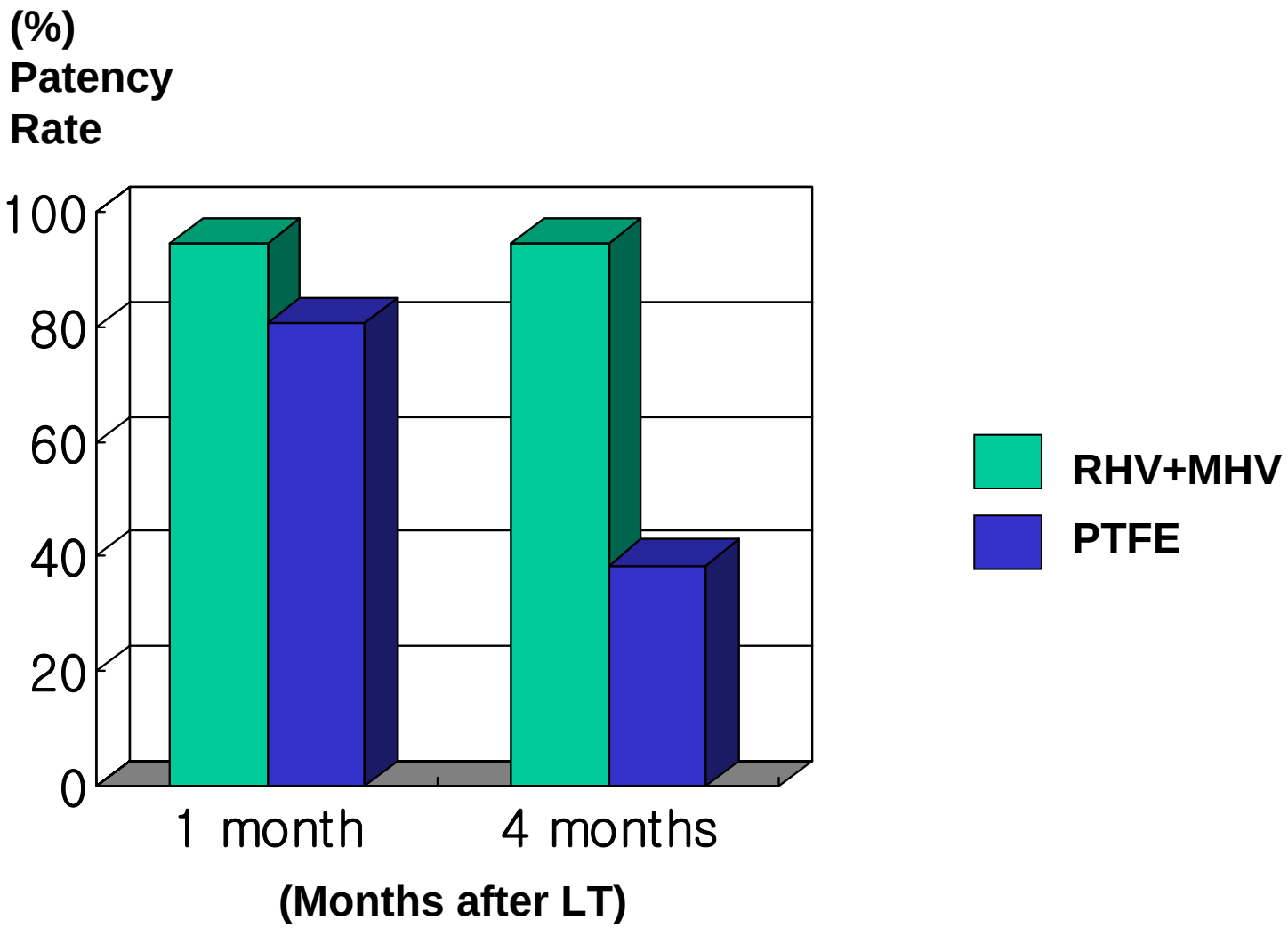
Conclusions: Our results show that MERH didn't impair recovery or liver regeneration in donors, and indicate that MERH will be useful in adult living donor liver transplantation.

KEY WORDS: Extended right hepatectomy; Right hepatectomy; Modified extended right hepatectomy; Living donor liver transplantation

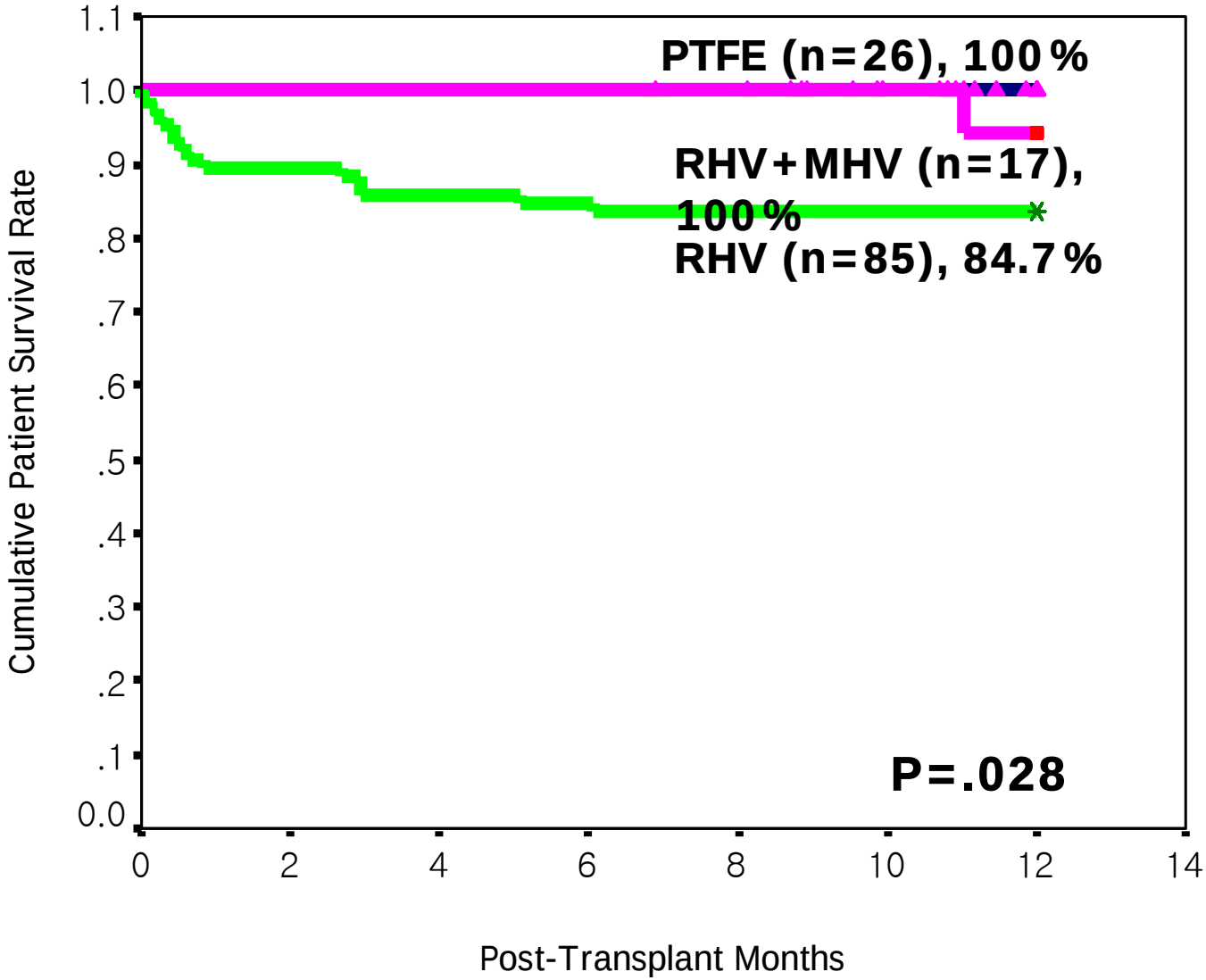
ABBREVIATIONS: Adult Living Donor Liver Transplantation (ALDLT); Computed Tomography (CT); Modified Extended

AN ARTIFICIAL VASCULAR GRAFT IS A USEFUL INTERPOSITION MATERIAL FOR ANTERIOR SECTION DRAINAGE OF A RIGHT LIVER GRAFT

Liver Transplantation in press


(%)
Patency
Rate
100
80
60
40
20
0
1 month
4 months
(Months after LT)
RHV+MHV
PTFE

6-mo Patient Survival Rate



- One- and 4-mo patency rate of the ePTFE graft was 80.8% and 38.5%.
  - No symptom ass. with the late ePTFE graft obstruction
  - No infectious complication of the ePTFE graft
- *An artificial ePTFE grafts can be a used an interposition vessel graft for anterior drainage without serious complications.*

Safety of Right Lobectomy in Living Donor Liver Transplantation

Kyung-Suk Suh, Seong Hoon Kim, Sang Beom Kim, Hyuk-Joon Lee, and Kuhn Uk Lee

The goal of this study was to examine the safety and effectiveness of right lobectomy in living donor liver transplantation (LDLT). From January 1999 to January 2002, 100 cases of LDLT were performed at Seoul National University Hospital; 45 involved right lobectomy (RL), 17 involved extended left lobectomy (ELL), 37 involved left lateral segmentectomy (LLS), and 1 involved right posterior segmentectomy. The outcome of RL was compared with those of other types of hepatectomy. An RL resulted in a longer operative time (minutes) than an LLS (349.0 ± 65.1 versus 286.7 ± 54.0, $P < .01$), but not an ELL (351.2 ± 84.3, $P = .99$). The hospital stay (days) in the RL group (14.4 ± 3.1) was longer than for those in the ELL group (11.7 ± 1.7, $P < .01$) and the LLS group (11.7 ± 1.9, $P < .01$). The drain amount (mL) of the postoperative third day in the RL group (194.4 ± 143.4) was larger than for those in the ELL group (56.8 ± 84.1, $P < .01$) and the LLS group (46.5 ± 39.6, $P < .01$). The postoperative peak serum level of total bilirubin (mg/dL) was 3.0 ± 1.5 in the RL group, 1.9 ± 0.7 in the ELL group, and 1.9 ± 0.9 in the LLS group ($P < .01$, RL versus LLS, ELL). There was no mortality or major morbidity and no reoperation of donors. Right lobectomy is a relatively safe and effective procedure in LDLT, but brings more potential risks and morbidity in donors. (*Liver Transpl 2002;8:910-915.*)

with the right lobe transplantation procedure and evaluate its safety and feasibility.

The goal of this study is to investigate the safety and effectiveness of right lobectomy in LDLT from the standpoint of living donor safety.

Materials and Methods

From January 1999 to January 2002, 100 cases of LDLT were performed in the Department of Surgery, Seoul National University Hospital. Of a total of 100 cases of donor hepatectomy, there were 45 cases of right lobectomy (RL), 17 cases of extended left lobectomy (ELL), 37 cases of left lateral segmentectomy (LLS), and 1 case of right posterior segmentectomy. In RL, the middle hepatic vein was left in the remnant liver of the donor. The living donors consisted of 20 mothers, 16 fathers, 18 sons, 10 spouses, 8 daughters, 7 nephews, 5 brothers, 3 uncles, 6 cases of other relatives, and 7 unrelated but acquainted neighbors (Table 1). The age and weight of the donors ranged from 17 to 49 years (29.5 ± 7.6 years) and from 40 to 87 kg (64.9 ± 10.6 kg), respectively. The follow-up period for the 100 donors who underwent donor hepatectomy was 24.6 ± 7.8 months, with a range from 3.0 to 38.5 months. Types of donor hepatectomy were deter-

Clinical Outcome of 300 Consecutive Living Liver Donors

Kyung-Suk Suh, Eung-Ho Cho, Sung Hoon Yang,
Hae Won Lee, Jai Young Cho, Yong Beom Cho, Nam-Joon Yi,
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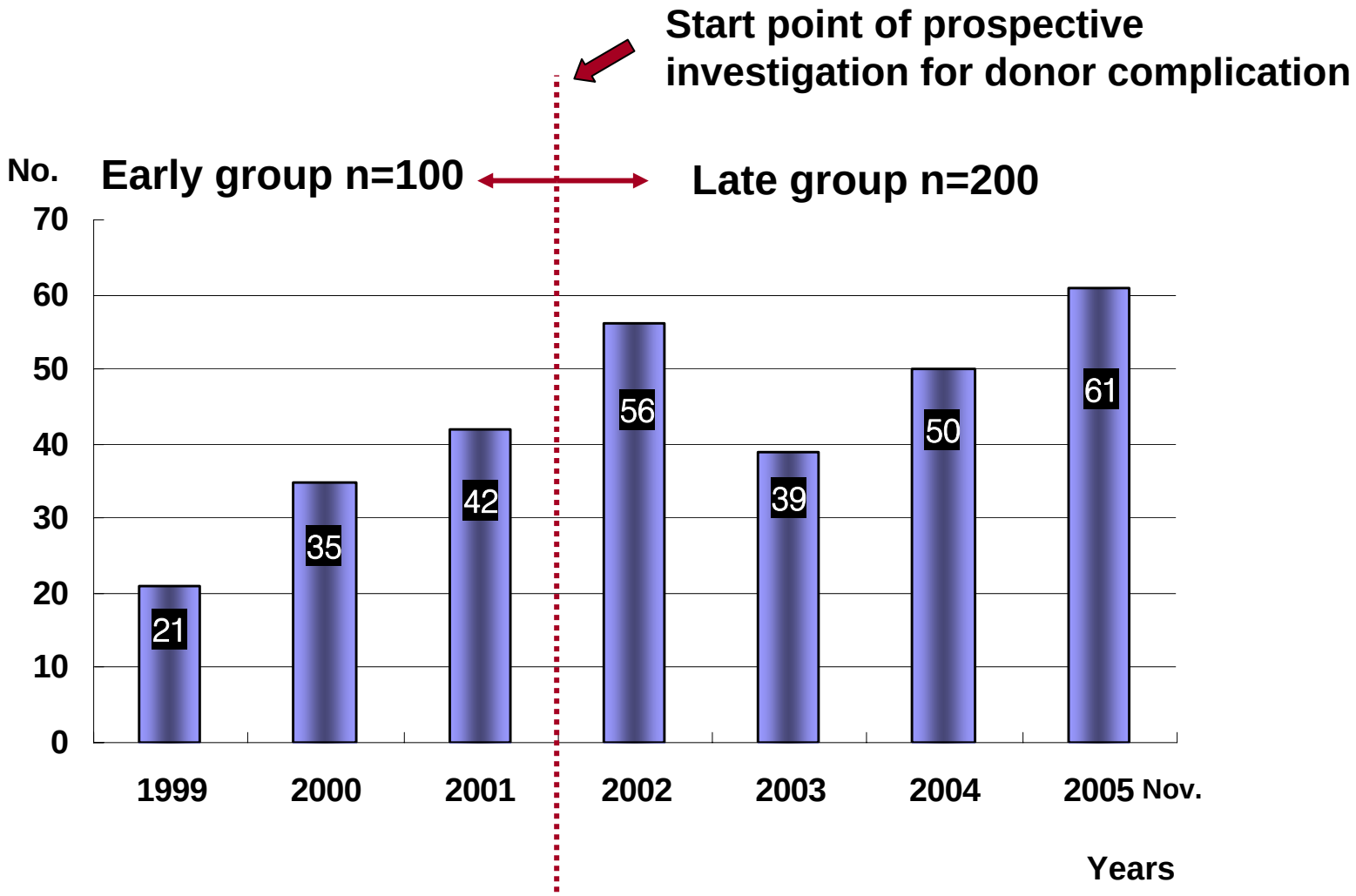
in submission

Annual Cases of LDLT (n=300)



Results of 300 Donors

- No mortality
- No reoperation
- No intraop. transfusion of blood product

Comparison of Outcomes Between Early and Late Groups

Clinical Data

	Early group (n=100)	Late group (n=200)	*p* value
Male/Female	59/41	141/59	0.052
Age (years)	30.0 ±7.8	31.6 ± 8.9	0.131
Graft (Rt. : Lt.)	45 : 55	141 : 59	<0.001
Operation time (min)	314.8 ±66.8	285.2 ±49.0	0.002
Intraop. blood loss (ml)	423.1± 205.4	383.0 ±201.9	0.317
Postop. hospital stay (days)	13.1 ±3.6	11.6 ±3.0	0.778

Complication Rate

	Early group (n=100)	Late group (n=200)	*p* value
Complications	4 (4%)	95 (47.5%)	
Grade I	0	57 (28.5%)	
Grade II	1 (1.0%)	35 (17.5%)	<0.05
Grade III	3 (3.0%)	3 (1.5%)	

Complications in Early Group
(4 patients)

	Complication	Management
Grade II (1 patient)	Postoperative ascites	Conservative management
Grade III (3 patients)	Iatrogenic pneumothorax	Closed thoracotomy
	Fluid collection at op. site	Percutaneous drainage
	Rt. subphrenic abscess	Percutaneous drainage

Complications in Late Group
Modified Clavien Grade (I)

Grade I (57 patients)	Hyperbilirubinemia[1]	42
	Abdominal fluid collection	18
	Wound problems	13
	Pleural effusion	13
	Ascites	6
	Voice change	3
	Hepatic vein stenosis	2

[1] Hyperbilirubinemia : total bilirubin > 3mg/dL > 3 days or > 1.3 mg/dL after POD 7

Complications in Late Group
Modified Clavien Grade (II)

Grade II (35 patients)	Bile leak[1]	17
	Ileus	7
	Bleeding	8
	Antibiotics	5
	Accidental postoperative transfusion	2

[1] **Bile leak : drain fluid bilirubin > 2 x serum bilirubin, sustained mort than POD 7**

Complications in Late Group
Modified Clavien Grade (III)

	Anaphylactic reaction due to CT dye	1
Grade III (3 patients)	Pelvic abscess of unknown origin	1
	Bile leak with percutaneous drainage	1

Summary

- In our series, no donor mortality, reoperation, or intraoperative transfusion occurred.
- In chronological analysis,
  - Minor complications were ignored under retrospective review (4.0% in early group vs 47.5% in late group).
  - Recently, right liver donation is more frequent than left liver (right liver donor: 45.0% in early group vs 70.5% in late group).

Small-for-Size Syndrome

- Recognizable clinical syndrome which occurs in the presence of a reduced mass of liver insufficient to maintain normal liver function
  - Poor bile production
  - Delayed synthetic function
  - Prolonged cholestasis
  - Intractable ascites

  → **septic complication → mortality**
- Graft-to-recipient weight ratio (GRWR) > 0.8~1.0%
  - Graft selection of the living donor: left liver graft → right liver graft

Dahm et al. Am J Transplant. 2005; 5: 2605-10

Survival of small-for-size graft

- Suguwara et al, J Am Coll Surg 2001

  GV/SLV <40% : 80%

  >40% : 96%

- Kiuchi et al, Transplantation 1999

  GRWR <0.8 : 58%

  0.8 – 1 : 76%

  >1 : 83%

- Nichizaki et al, Ann Surg 2001

  GV/SLV <30% : 100%

  30-40% : 75%

  >40% : 90%

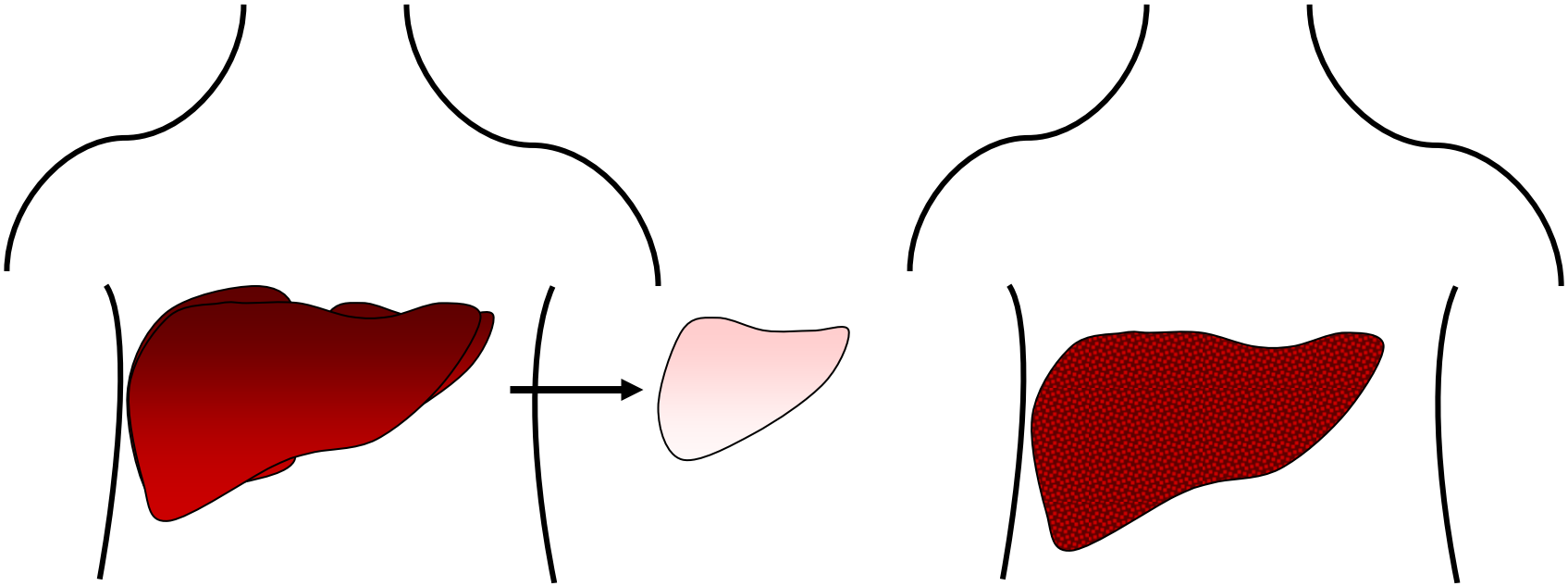
Small-for-size partial liver graft in an adult recipient; a new transplant technique.

Boillot O, Delafosse B,Mechet I,Boucaud C,Pouyet M.

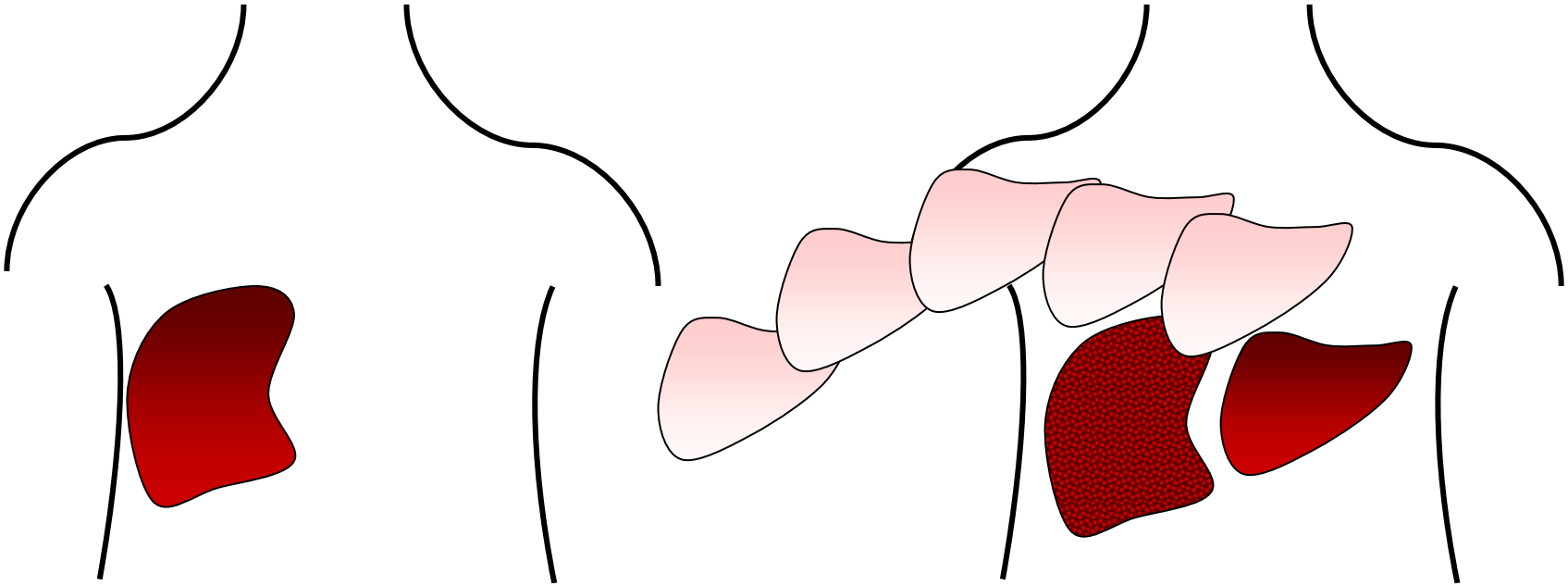
We report a new technique of adult liver transplantation using a small-for-size graft. In order to avoid graft congestion and failure by overperfusion, we ***completely diverted the superior mesenteric venous flow by a mesocaval shunt with downstream ligation of the superior mesenteric vein***. The recipient recovered well, and the graft had normal histology and function at 5 months follow-up. Given the current scarcity of cadaveric donors, this technique may increase the numbers of adult recipients by using left lobes from cadaveric split liver grafts.

Lancet. 2002 Feb 2;359(9304):406-7.

Auxiliary Partial Orthotopic LT(APOLT) (living or cadaveric)



Auxiliary Partial Orthotopic LT(APOLT) (living or cadaveric)



Outcome of SFSG in SNUH

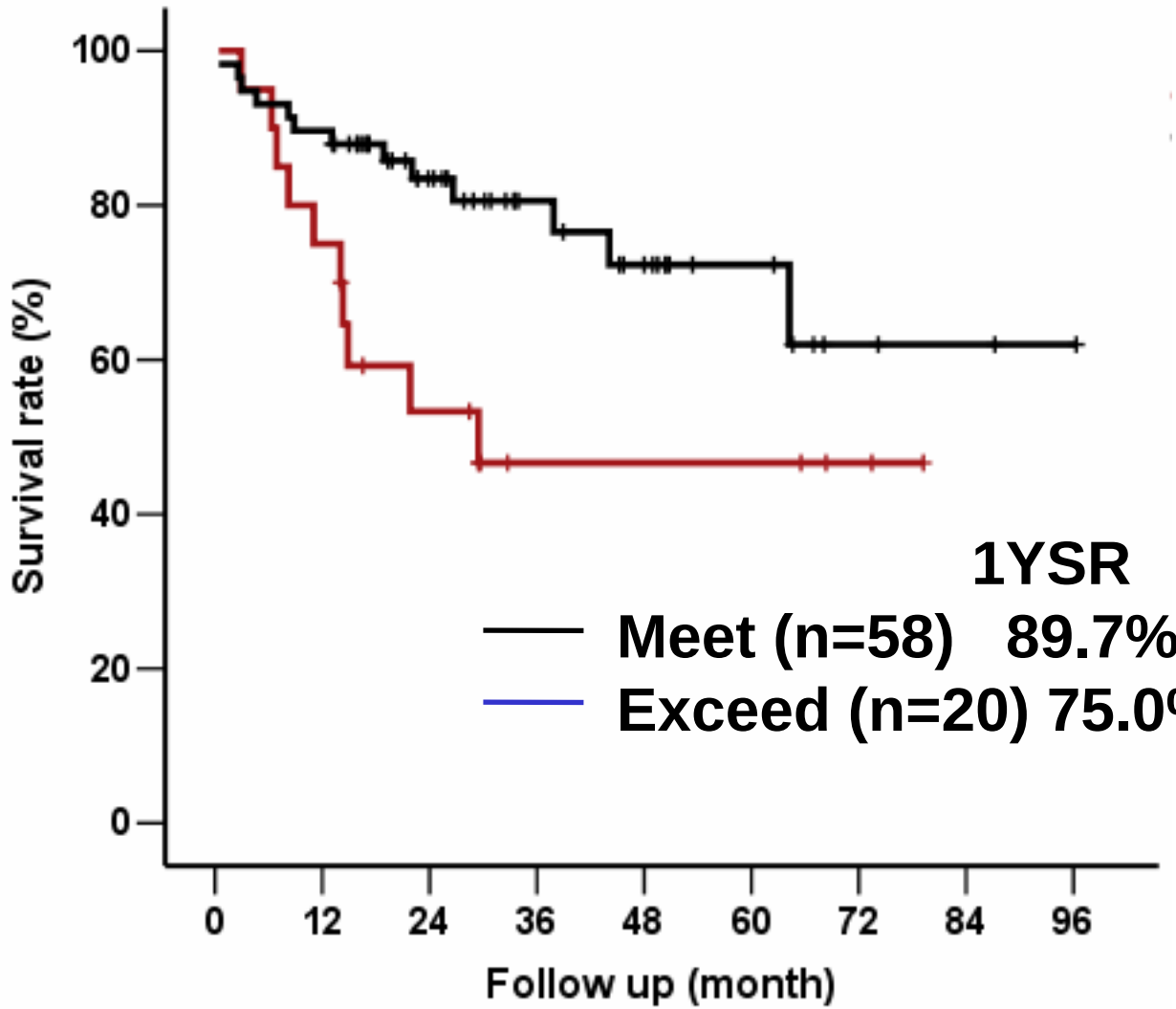
- **29 recipients with a SFSG (GRWR <0.8%)**
- **One-year patient survival rate**
  - Rt. (100%) vs. Lt. liver graft (66.6%)
  - Cause of death: Graft failure & sepsis
- **More significant SFSS in left SFSG**
  - Hyperbilirubinemia and uncontrolled ascites was more common in left liver recipient.
  - All left liver recipients had SFSS.
  - One-third right liver recipients with good graft condition had no SFSS.

Anti-tumor effect, hepatic function and viral clearance in treatment modalities for HCC

	Anti-tumor effect	Removal of carcinogenic liver	Hepatic function	Viral clearance
Surgery	**≥ 100%**	**some**	↓ ↓	**No, even aggravate**
TACE	**40-80%**	**No**	↓	**No**
PEI	**80%**	**No**	↓	**No**
Liver TPL	**≥ 100%**	**Yes**	↑ ↑	**Yes, in Hep B** **No, even aggravate in Hep C**

Disadvantage of TPL : graft failure, infection, donor organ shortage, high cost, risk of life long immunosuppression

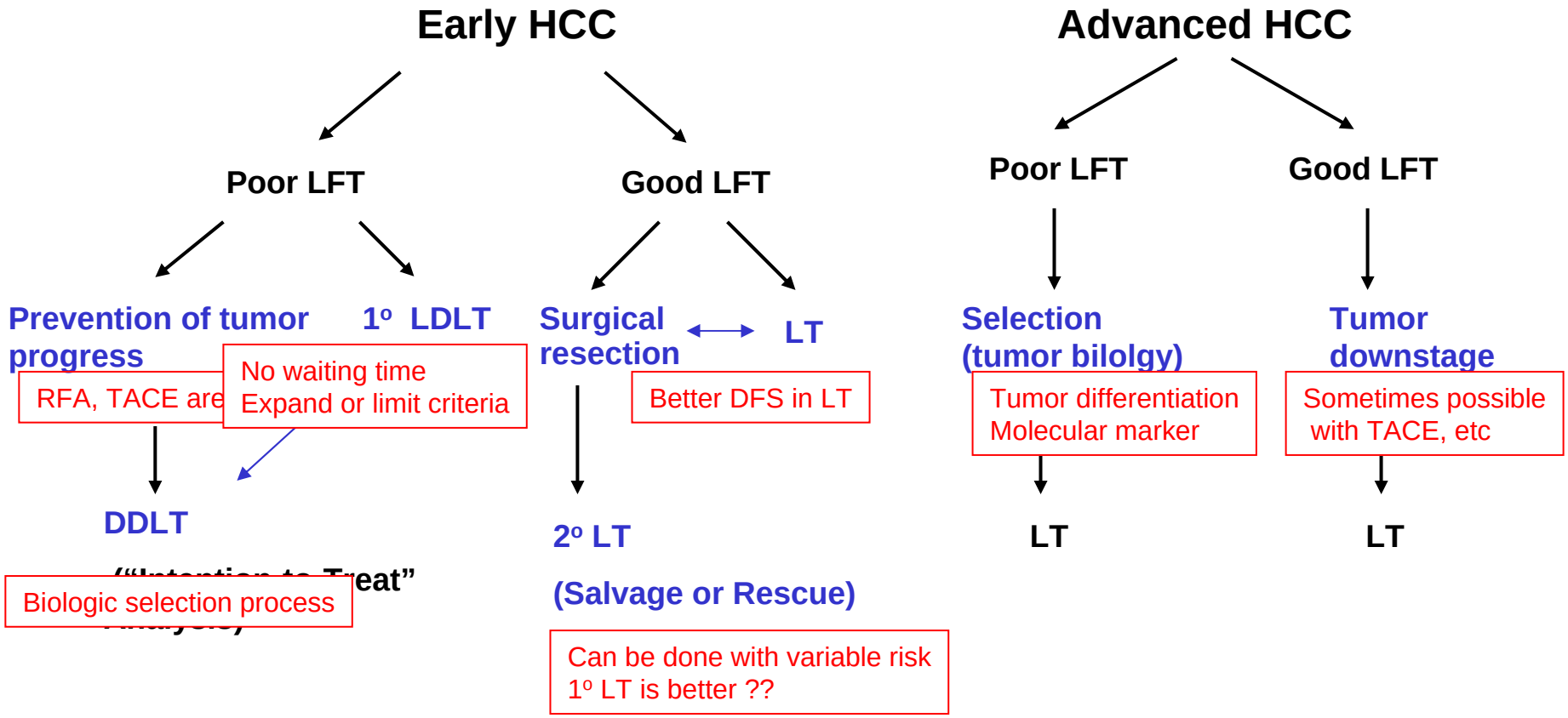
Survival according to Milan criteria



P = 0.023

	1YSR	3YSR	5YSR
Meet (n=58)	89.7%	80.6%	72.3%
Exceed (n=20)	75.0%	46.6%	46.6%

Strategy of Liver Transplantation For HCC



Early : within Milan, Advanced : Beyond Milan

ORIGINAL ARTICLE

The Role of ^{18}F-FDG-PET Imaging for the Selection of Liver Transplantation Candidates Among Hepatocellular Carcinoma Patients

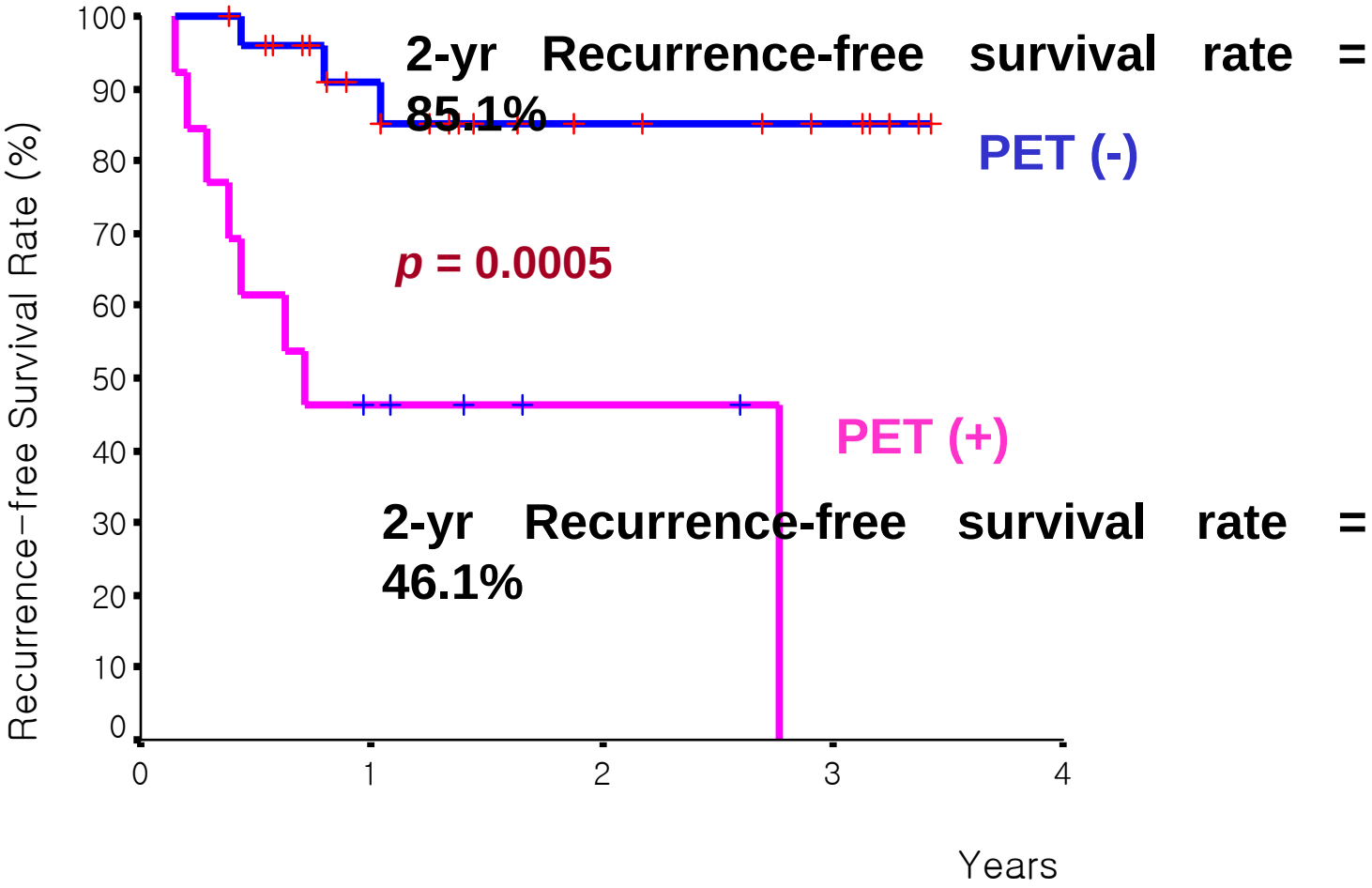
Sung Hoon Yang, Kyung-Suk Suh, Hae Won Lee, Eung-Ho Cho, Jai Young Cho, Yong Beom Cho, Nam-Joon Yi, and Kuhn Uk Lee

Department of Surgery, Seoul National University College of Medicine, Seoul, Korea

Positron emission tomography (PET) using F-18 fluoro-2-deoxy-d-glucose (^{18}F-FDG) is now well established as a noninvasive diagnostic tool for the detection of a variety of malignant tumors. However, in the case of hepatocellular carcinoma (HCC), several investigators have reported controversial conclusions and an inadequate sensitivity for PET (50-55%). Nevertheless, a high positive rate of ^{18}F-FDG accumulation has been reported in patients with high-grade HCC and in those with markedly elevated alpha-fetoprotein (AFP) levels. Here, we retrospectively reviewed 38 HCC cases that received liver transplantation (LT) at our center between November 2000 and July 2004 and underwent whole-body PET imaging. ^{18}F-FDG uptake was assessed in the liver, and its prognostic significance was investigated. Of 38 patients enrolled, 13 patients had positive PET scans for a liver tumor. When we analyzed the association between tumor factors and PET+ (greater PET lesion uptake) in the liver, preoperative AFP level and vascular invasion were found to be significantly associated with PET+ ($P = 0.003$ and $P < 0.001$, respectively). However, the association between histological grade and PET+ findings did not reach statistical significant difference ($P = 0.074$). Moreover, the 2-year recurrence-free survival rate of PET− patients was significantly higher than that of PET+ patients (85.1% vs. 46.1%) ($P = 0.0005$). Of 6 PET+ patients who met the Milan criteria, 4 patients (66.7%) had recurrence, but all 20 PET− patients who met the Milan criteria were recurrence free. Thus, PET imaging could be a good preoperative tool for estimating the post-LT risk of tumor recurrence, because histological grade and vascular invasion cannot be determined preoperatively. Importantly, our results indicate that tumor recurrence can be highly anticipated for PET-imaging-positive HCC patients who satisfy the Milan criteria. We advise that PET+ HCC patients be selected cautiously for LT.
Liver Transpl 12:1655-1660, 2006.

Received March 4, 2006; accepted May 9, 2006.

Cumulative recurrence -free survival curve according to ^{18}F-FDG-PET imaging



Yang et al, Liver Transplantation 2006

A Scoring Criteria that Devised as Selection Criteria for Living Donor Liver Transplantation in Hepatocellular Carcinoma

Sung Hoon Yang[1], Hae Won Lee[1], Eung-Ho Cho[1], Jai Young Cho[1], Yong Beom Cho[1], In Hwan Kim[2], Nam-Joon Yi[1], Kuhn Uk Lee[1], Kyung-Suk Suh[1]

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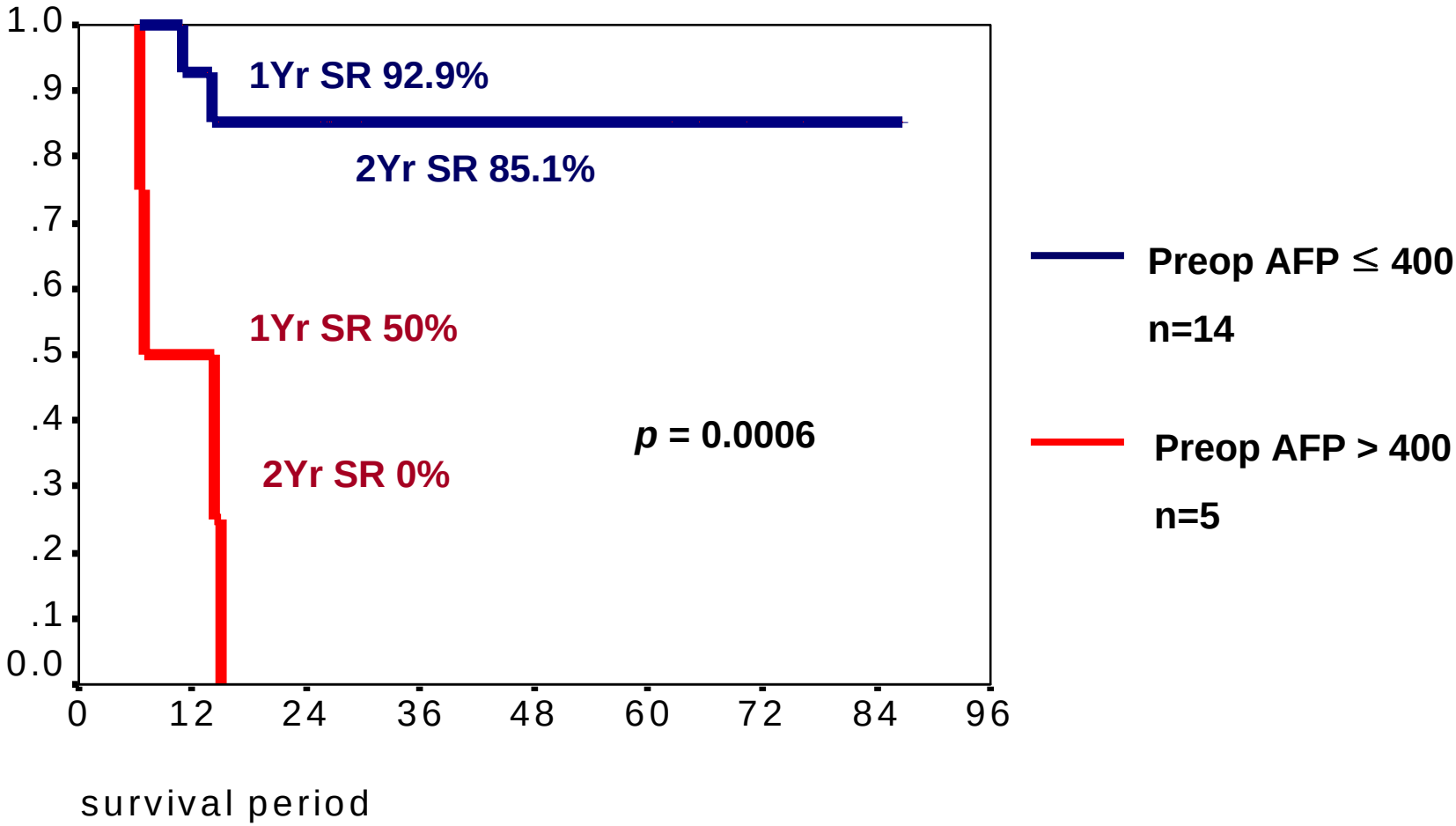
[2]Department of Radiology, Seoul National University College of Medicine, Seoul, Korea

Key words: transplantation, liver; hepatocellular carcinoma; selection criteria; scoring criteria; survival rate.

Surgery in press

Beyond Milan

Survival according to serum AFP, 400 ng/ml (n=15/4)



Scoring criteria

Tumor Factors	Number of Points*			
	1	2	3	4
Size† (cm)	≤ 3	> 3, ≤ 5	> 5, ≤ 6.5	> 6.5
Number (nodules)	1	2, 3	4, 5	≥ 6
AFP (ng/mL)	≤ 20	> 20, ≤ 200	> 200, ≤ 1000	> 1000

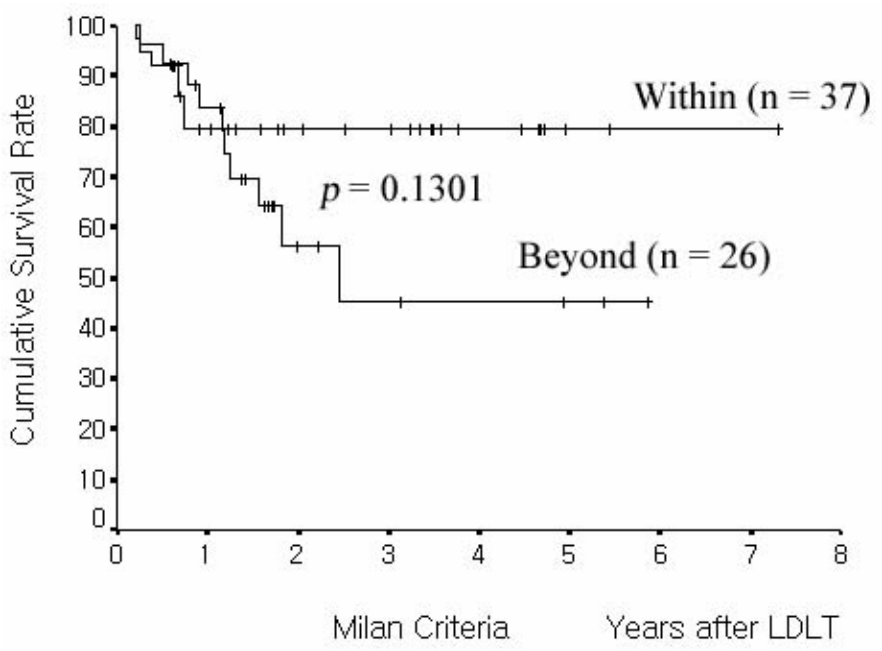
*: 3-6 points : Select as the candidates for LT,

7-12 points : Exclude from the candidates for LT

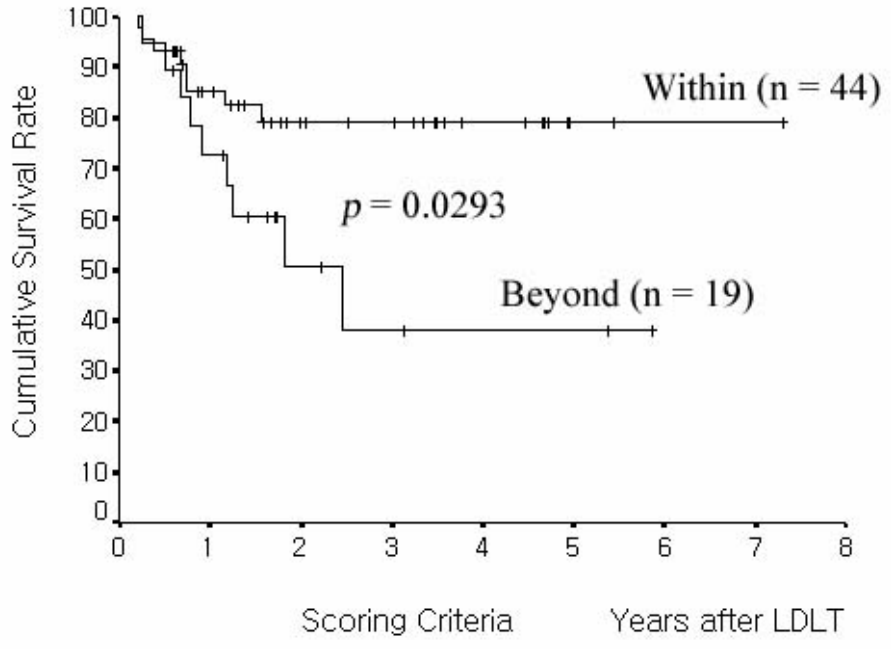
†: Diameter of the largest tumor

Cumulative survival rate according to criteria based on pre-op data

Milan



Scoring



Summary

- **Safe remnant volume in live liver donor**
  - **Remnant <35% is relatively safe**
- **MHV reconstruction**
  - **PTFE graft is safe and useful**
  - **Modifed extended right graft guarenttees good flow**
- **Outcome of 300 live donors**
  - **No mortality, No transfusion, No reoperation**
- **Small-for-size graft**
  - **Excellent outcome especially in Right graft**
- **LDLT for HCC**
  - **New criteria are needed.**