

6. Ulusal CERRAHI ONKOLOJİ KONGRESİ  
24 - 27 Şubat 2022 | Gloria Golf Resort - ANTALYA

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ESKİŞEHİR OSMANGAZİ ÜNİV. TIP FAKÜLTESİ

**Karaciğer remnant volümü yetersizliğinde neler yapılabilir ?**

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**Karaciğer**  
Hepar (Repairable, onarılabılır)

Rejeneren olan tek organ (eşsiz)

Patofizyolojik cevap: Atrofi  
Restoratif cevap: Hipertrofi

**Atrofi + kompensatuar hipertrofi**



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**Karaciğer rejenerasyonu**

Karaciğer hasarı → Hipertrofi + hiperplazi

Mekanizma: ?  
Portal venöz sistemdeki akım değişiklikleri

Sitokinler (TNF, IL-6) ve büyüme faktörleri (HGF, TGF, EGF) ile düzenlenir

Priming  
Proliferasyon  
Terminasyon

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**Hepatektomi sonrası karaciğer yetmezliği**

Post-hepatectomy liver failure (PHLF), %8 (1,2 – 32)

Tanım

Postoperatif dönemde

sentetik ekskretuar detoksifikasyon ↓

Postop. 5. gün veya sonrasında INR artışı, hiperbilirubinemi

(Surgery 2011;149:713-24.) Posthepatectomy liver failure: A definition and grading by the International Study Group of Liver Surgery (ISGLS)

Table II. Consensus definition and severity grading of posthepatectomy liver failure (PHLF) by the International Study Group of Liver Surgery (ISGLS)

Definition: A postoperatively acquired deterioration in the ability of the liver (in patients with normal and abnormal liver function) to maintain its synthetic, excretory, and detoxifying functions, characterized by an increased INR (or need of clotting factors to maintain normal INR) and hyperbilirubinemia (according to the normal cut-off levels defined by the local laboratory) on or after postoperative day 5. If INR or serum bilirubin concentration is increased preoperatively, PHLF is defined by an increasing INR (decreasing prothrombin time) and increasing serum bilirubin concentration on or after postoperative day 5 (compared with the values of the previous day). Other obvious causes for the observed biochemical and clinical alterations such as biliary obstruction should be ruled out.

Grade:

A: PHLF resulting in abnormal laboratory parameters but requiring no change in the clinical management of the patient.

B: PHLF resulting in a deviation from the regular clinical management but manageable without invasive treatment.

C: PHLF resulting in a deviation from the regular clinical management and requiring invasive treatment.

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**PHLF riskinin belirlenmesi**

Risk factors for post hepatectomy liver failure (PHLF).

Patient Factors	Male sex Advanced age (> 65 years) Obesity (BMI > 30) Co-morbidities (Diabetes mellitus) Malnutrition
Factors Related to Quality of Hepatic Parenchyma	Cirrhosis/Fibrosis Cholestasis Steatosis Chemotherapy associated hepatotoxicity
Intraoperative Factors	Intraoperative blood loss (> 1000 ml) Prolonged operating time Hypotension Prolonged in-flow occlusion (Pringle) Vascular reconstruction Ex-situ resection Small for size syndrome Sepsis Postop hemorrhage (bleeding)
Postoperative Factors	

Remnant karaciğer hacmi (Future liver remnant) (FLR)

Cerrahi faktörler

Rezeksiyon genişliği  
Intraop. İskemi süresi  
Cerrahi süresi  
Transfüzyon ihtiyacı

Karaciğer parankiminin kalitesi

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### FLR optimizasyonu

- FLR hacmi
- PVE sonrası FLR hipertrofi derecesi
- PVE sonrası Kinetic growth rate (KGR)

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TLV<sub>Measured</sub> = V<sub>Total Liver</sub> - V<sub>Tumor</sub>  
 FLR<sub>Measured</sub> = LRV/TLV<sub>Measured</sub> × 100%

TLV<sub>Standard</sub> = (1267.28 × BSA) - 794.41  
 FLR<sub>Standard</sub> = LRV/TLV<sub>Standard</sub> × 100%

**The Future Liver Remnant: Definition, Evaluation, and Management**

Matthew Dixon, MD<sup>1</sup>, Jeffrey Cruz, MD<sup>1,2</sup>,  
 Nabeel Sarwar, MD<sup>1</sup>, and Niraj Gusani, MD, MPH<sup>1,3,4</sup>

1: The American Surgeon 2021; 147(12):274-286  
 2: J Hepatol 2021  
 3: Ann Surg 2021  
 4: Hepatology 2021  
 ©SAGE

Liver volume characteristic	Minimum acceptable value
Minimum acceptable FLR <sub>Standard</sub> liver volumes	Normal liver parenchyma ≥20% Prior chemotherapy ≥30% C-P A cirrhosis ≥40%
Degree of hypertrophy after PVE	≥5%
Kinetic growth rate after PVE	≥2%

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### Karaciğer dokusunun kalitesi

FOLFOX (oxaliptin) → Sinüzoidal obstrüksiyon sendromu  
 Irinotecan → Steatohepatit

Fibrozis  
 Siroz

Portal ht  
 Ascites  
 Bilirubin yüksekliği  
 PT yüksekliği

**Majör olmayan rezeksiyonlar bile tolere edilemeyebilir**

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### FLR volümü (volümetrik inceleme)

Üç boyutlu BT rekonstrüksiyonu (FLR/TLV)

### FLR fonksiyonunun değerlendirilmesi

KCFT, albümin, pıhtılaşma faktörleri

Child Skoru, MELD

ICG retansiyonu  
 LiMax testi

USG (Elastogram)

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### MRI

Gadolinium ethoxybenzyl diethylenetriamine pentaacetic acid (Gd-EOB-DTPA)

### Global ve segmental fonksiyon değerlendirmesi

Parankimal steatoz, fibrozis

### Sintigrafi

99mTc-mebrofenin hepatobilyer sintigrafi (HBS) (global ve segmental)  
 99mTc-GSA (global ve segmental)

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### Portal Ven Embolizasyonu

RELATION OF THE PORTAL BLOOD TO LIVER MAINTENANCE.  
 A DEMONSTRATION OF LIVER ALDERTHE CONDITIONAL OF COMPENSATION.  
 BY PEYTON ROSS, M.D., AND LOUISE D. LARMORE, M.D.  
 (From the Laboratories of The Rockefeller Institute for Medical Research)  
 PAGES 47-51, 72.  
 (Received for publication, February 2, 1920.)

**SUMMARY.**

The occlusion of portal branches to a part of the liver of the rabbit leads to a progressive and ultimately complete **atrophy** of the parenchyma in the region deprived of portal blood, and to **hypertrophy** of the rest of the hepatic tissue which receives such blood in excess.

Lous and Larimore, 1920 (Deneyisel)

**1975**  
 İlk PVL  
 Horijo et al (Am J Surg 1975; 130: 296-302)

**1984**  
 Preop. Kateter embolizasyonu  
 İlk seri, güvenli ve etkili (perihiler kolanjoCa)  
 Makkuchi et al. (j jpn clin soc clin surg. 1984; 45: 14-21)

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## Portal Ven Embolizasyon (+ tek aşamalı hepatektomi)

**Cerrahi**

**Perkütan**

**İpsilateral**  
FLR hasarı riski düşük  
Segment 4'e daha kolay erişim

**Kontralateral**  
Kanülasyon kolaylığı,  
FLR hasarı

**Teknik başarı: >695**

**FLR hipertrofisi: %37,9 - %49,4**

**Hepatektomi: %75,9 - %96,1**

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## PVE(+ tek aşamalı hepatektomi)

**Teknik başarı: >695**

**FLR hipertrofisi: %37,9 - %49,4**

**Hepatektomi: %75,9 - %96,1**

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## Preparing for liver surgery with "Alphabet Soup": PVE, ALPPS, TAE-PVE, LVD and RL

DaHee Kim, Joshua Coombs-Hammill, Da HepatoBiliary Surg Natv 2020;9(2):136-151

**Table 1 Summary of meta-analysis and systematic reviews on PVE**

Author, year	Type	# included studies/patients	Morbidity/ mortality of PVE (%)	FLR increase (%)	Rates of successful resection (%)	Morbidity/ mortality post-resection (%)	Difference between ipsilateral/contralateral transhepatic approach	Difference between the choice of embolic
Abulkhir et al., 2008 (59)	Meta-analysis	37/1,088	2.2/0	8-27 (DH)	85	16/1.7	None	None
Wajswol et al., 2018 (60)	Meta-analysis and Systematic Review	18/607	3.1/not reported	49.4 (RH)	75.9	23.2/1.2	None	None
Isofordink et al., 2017 (61) and Systematic Review	Meta-analysis	17/1,953	3.9/not reported	43.2 (RH)	Not reported	Not reported/3.8	Not reported	Not reported
van Lienden et al., 2013 (62) and Systematic Review	Meta-analysis	44/1,791	2.5/0.1	37.9 (RH)	80	10.4/3.3	Not reported	NBCA with greater FLR increase than gelfoam, PVA and fibrin glue

### Ulusal CERRAHI ONKOLOJİ KONGRESİ

## Preoperative Portal Vein Embolization for Major Liver Resection A Meta-Analysis

Ann Surg 2008;247: 49 - 57

**Table 1. Summary 37 Publications on Portal Vein Embolization**

Details	No. (%)
Total no. patients	3088
Pathology	
HCC 15,518,12, 21,28, 27	265 (24)
CHC 14,15,14,12, 15,15,24,29, 30,33, 40	430 (39)
Others 13,12,13,13, 13,15,23,23,23,28, 31,34, 37,38, 41,46, 49	393 (36)
Embolization method	
PVE 15,12, 13,13, 13, 23,23,23, 31, 42,44,48, 49	784 (72)
TAE 16,13,17,18,19,40,45,47	304 (28)
Embolization materials	
Cyanacrylate + lipidol 17,20,34,47,49	169
Gelfoam + thrombin + urografin 16,17,17,17,42,47	309
PVA + coil + lipidol + fibrin glue 17,33,34	66
Fibrin glue + lipidol + PVAl 17,23,23,23,41,44,48	80
Gelfoam + urografin + protamine 17,17,17,46,47	123
Embol-787	51
Gelfoam + coil 17,20,34,49	137
PVA + micro coils 15,23,47	153
Volumetric change	
Pre-PVE	16-44
Post-PVE	24-69
Percentage increase (%)	8-27
Timing of CT scan post-PVE (week)	2-6
Length of time post-PVE to operation (day)	2-60
Resection post-PVE	930 (85)
No resection post-PVE	158 (14)

**Table 2. Complications Following Portal Vein Embolization**

Details	No.
Minor complications	
Abdominal discomfort or pain 17,32,32, 34,48	209
Fever 17,24,37, 34,36,48, 48	250
Nausea or vomiting 22,34	26
Hesitancy 1	9
Overflow of embolization materials 31	2
Coil displacement 23	3
Major complications	
Liver abscess 39	3
Cholangitis 42,9	2
Main or left portal vein thrombosis 12,2	2
Subcapsular hematoma 23	2
Portal hypertension 23	1
Septic necrosis from hepatic artery injury 3	1

### Ulusal CERRAHI ONKOLOJİ KONGRESİ

## Preoperative Portal Vein Embolization for Major Liver Resection A Meta-Analysis

Ann Surg 2008;247: 49 - 57

### PVE (+ tek aşamalı hepatektomi)

PVE sonrası morbidite: %2,2  
PVE sonrası mortalite: 0

Hepatektomi: %85 (29 gün sonra)

Hepatektomi yapılamayan %14

**43 hasta karaciğer metastaz progresyonu**  
**35 hasta ekstrahepatik yayılım**  
**18 hasta yetersiz hipertrofi**

Hepatektomi sonrası geçici yetmezlik: %2,5  
Hepatektomi sonrası akut yetmezlik, ölüm: %0,8

### Ulusal CERRAHI ONKOLOJİ KONGRESİ

## Preoperative Portal Vein Embolization for Major Liver Resection A Meta-Analysis

Ann Surg 2008;247: 49 - 57

### PVE (+ tek aşamalı hepatektomi)

Teknik başarı: %69

Majör komplikasyon: 3,1

İnterval: 2-10 hafta

Hipertrofi: %49

Hepatektomi: %76

Hepatektomi yapılamayan

**Progresyon: 114 hasta**  
**Yetersiz hipertrofi: 24 hasta**

**Table 3 Selected studies included in meta-analysis and percentage increase following portal vein embolization**

Study	% Increase in FLR following embolization
Peregini et al.	38.9 ± 28.4%
Kim et al. [18]	30.3 ± 28.3%
Kaneko et al.	25 ± 5.9%
Jaheri et al.	49.5 ± 46.6%
Gniu et al.	74 ± 69%
Girardo et al.	48 ± 32%
de Baere et al.	69 ± 45%
Dessy et al. [13]	41 ± 32%
Broering et al.	69.4 ± 42.8%
Bent et al.	68.9 ± 12%
Barbaro et al.	52.9 ± 39.7%
Luz et al.	52 ± 22%

**FRL volumetric share (%) =  $\frac{FRLV}{TIV - TV} \times 100\%$**

**99mTc-mebrofenin HBS**

**Functional share (%) =  $\frac{\text{Counts FRL}}{\text{Counts total liver}} \times 100\%$**

**Fonksiyonel cevap > volüm cevabı**

	Pre-PVE	Post-PVE	p value
<b>Functional share S2-3 (n=141)</b>			
All (n=90)	72.2 (12.3-22.8)	30.2 (25.4-35.9)	77.6 (39.8-112.2) <.01
CRM (n=49)	79.9 (24.0-20.0)	26.3 (20.2-32.1)	82.4 (45.0-109.8) <.01
PHC (n=20)	22.4 (16.0-28.2)	33.1 (30.2-42.3)	47.8 (17.8-105.8) .02
HCC (n=7)	20.0 (20.0-20.0)	36.0 (30.2-42.3)	66.5 (44.3-105.0) .02
Benign (n=6)	10.0 (10.0-21.2)	28.6 (21.8-35.1)	93.0 (32.1-128.3) .02
Other (n=8)	21.5 (16.0-26.8)	35.8 (31.8-47.9)	94.2 (22.0-148.4) .02
<b>FRLV S2-3 (%)</b>			
All (n=90)	16.7 (12.6-21.2)	23.8 (18.5-27.9)	41.8 (28.6-56.3) <.01
CRM (n=49)	14.2 (10.9-19.2)	20.8 (15.7-24.6)	46.0 (33.3-65.7) <.01
PHC (n=20)	18.4 (13.1-21.6)	28.7 (21.4-30.2)	41.8 (27.6-56.0) <.01
HCC (n=7)	22.2 (15.3-24.7)	26.2 (24.1-35.2)	42.8 (20.6-67.2) .02
Benign (n=6)	12.7 (11.3-20.4)	24.5 (18.9-35.0)	49.1 (20.9-97.0) .02
Other (n=8)	21.1 (19.4-24.9)	28.6 (25.1-32.0)	30.0 (22.9-37.8) .01
<b>Functional share S2-4 (n=97)</b>			
All (n=90)	31.6 (24.6-36.7)	51.6 (44.6-61.1)	61.4 (38.1-104.6) <.01
CRM (n=49)	39.9 (24.2-34.0)	48.4 (40.3-57.7)	61.2 (34.9-97.6) <.01
PHC (n=20)	30.6 (29.2-49.6)	50.8 (50.0-64.9)	52.2 (31.0-87.6) <.01
HCC (n=7)	41.3 (31.0-46.3)	58.0 (48.7-65.1)	40.4 (21.7-122.6) .02
Benign (n=6)	29.0 (22.2-37.2)	53.0 (41.6-67.0)	76.4 (29.5-105.7) .02
Other (n=8)	31.7 (24.6-42.1)	57.3 (45.1-61.6)	75.0 (30.5-145.8) .02
<b>FRLV S2-4 (%)</b>			
All (n=90)	30.1 (23.6-34.8)	40.8 (34.2-45.4)	36.8 (24.0-60.7) <.01
CRM (n=49)	28.4 (22.2-32.7)	38.5 (30.7-43.4)	41.6 (28.4-63.1) <.01
PHC (n=20)	32.6 (25.3-36.0)	43.6 (38.1-48.0)	35.0 (18.0-65.5) <.01
HCC (n=7)	33.0 (25.9-38.6)	44.7 (34.2-53.0)	32.2 (24.1-47.1) .02
Benign (n=6)	32.7 (21.8-40.5)	41.1 (36.4-49.6)	28.1 (0.1-97.9) .12
Other (n=8)	31.5 (28.2-40.7)	52.1 (36.3-56.2)	63.4 (20.3-101.1) .02

**PVE**

Güvenli, etkili

Uzun bekleme süresi

Tümör progresyonu

Yetersiz büyüme (%50'ye yaklaşabilir)

Bekleme süresi: Konsensus yok

3. Hafta sonunda büyüme plato çizmeye başlıyor

3. haftada fonksiyonel augmentasyon daha iyi

Bekleme süresi azaltılabilir mi?

**Bekleme süresi azaltılabilir mi?**

Future Liver Remnant (FLR) Increase in Patients with Colorectal Liver Metastases is Highest the First Week After Portal Vein Occlusion

FLR increase in Patients with OLR1 is Highest the First Week After PVO

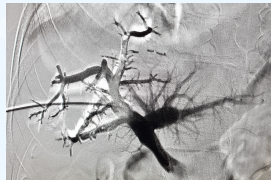
Volumetry	Entire PVO cohort (n=48)	Treated with radical hepatectomy (n=27)	Failure to achieve sufficient volume (n=14)	Tumor progression (n=7)	p value
FLR pre-PVO (percent of standardized FLR)	21 ± 5	23 ± 4	17 ± 5	22 ± 5	<.005*
FLR pre-PVO (ml)	365 ± 105	415 ± 95	281 ± 77	331 ± 52	<.005*
KGR day 1-7 after PVO (%/week)	5.4 ± 4	7.0 ± 4	8.3 ± 2	2.6 ± 0.8	Ns
KGR between the first and second CT (%/week)	1.5 ± 2	2.2 ± 2	0.8 ± 0.8	2.4 ± 1	0.017*
Increase in ml from PVO to the last evaluation (ml)	156 ± 118	217 ± 123	79 ± 41	77 ± 39	<.005*
Increase in percent from PVO to the last evaluation (%)	43 ± 30	55 ± 33	31 ± 21	24 ± 13	0.044*
FLR at last volume assessment (percent of standardized FLR)	30 ± 10	35 ± 9	21 ± 5	27 ± 6	<.005*
Days between PVO and the first CT evaluation	10 ± 8				
Days between the first and second CT evaluation	22 ± 9				

Volume expansion of the FLR in patients with resectable colorectal liver metastases is largest during the first week following PVO. It is important to perform the first evaluation after PVO shortly after the first week in order to individualize the treatment and avoid unnecessary delay of treatment.

**PVE + S4**

Segment 4 portal dalların embolizasyonu → Daha fazla FLR hipertrofi ?

Volüm artışı belirgin fazla (%47-54 vs %26-38)



**PVE + S4**

Liver volume data and portal vein embolization procedural related information and outcome.

Variable	Total study population (n = 232)			Subgroup without segment 4 FLR (n = 123)		
	rPVE (n = 196)	rPVE + S4 (n = 36)	P value	rPVE subgroup (n = 91)	rPVE + S4 subgroup (n = 32)	P value
Total estimated liver volume, ml	1643 (1119-2533)	1676 (1009-2131)	0.815	1622 (1119-2153)	1676 (1009-2131)	0.416
Pre-PVE FLR, ml	380 (143-808)	333 (172-507)	0.013	325 (143-722)	333 (172-507)	0.982
Post-PVE FLR, ml	531 (225-1147)	479 (238-973)	0.133	450 (249-1013)	483 (258-973)	0.216
Pre-PVE standardized FLR, %	23.3 (8-53.3)	19.5 (10.9-41.3)	0.005	20.8 (8-55.3)	19.1 (10.9-41.3)	0.422
Post-PVE standardized FLR, %	32.4 (12.9-77.4)	27.3 (16.3-50.4)	0.111	28.5 (13.3-77.4)	27.1 (16.3-50.4)	0.746
FLR increase, ml	150 (-25-275)	151 (21-446)	0.290	112 (-27-270)	153 (21-446)	0.019
FLR increase, %	37.9 (-7.3-136)	47.0 (3.7-117.1)	0.020	36.7 (-7.3-113.8)	47.9 (3.7-117.1)	0.010
Days from PVE to radiology	28 (6-159)	27 (8-40)	0.727	27 (12-155)	27 (8-40)	0.302
Degree of hypertrophy	8.5 (-1.4-30.5)	8 (1.5-27.5)	0.468	7.5 (-1.4-28.7)	8.5 (1.5-27.2)	0.074
FLR segments in subgroup						
Segment 1-3				57 (62.6)	18 (56.3)	0.524
Segment 2-3				34 (37.4)	14 (43.8)	
Kinetic growth rate/week	2.1 (-0.4-8.9)	2.2 (0.5-11.2)	0.835	1.9 (-0.4-8.9)	2.3 (0.5-11.2)	0.110
PVE material			0.990			0.105
Particle based	76 (38.4)	14 (38.9)		54 (59.3)	13 (40.6)	
Glue based	120 (61.2)	22 (61.1)		37 (40.7)	19 (59.4)	

FLR: future liver remnant; PVE: portal vein embolization.

**PVE + S4**

FLR büyümesi daha fazla → Rezeksiyon oranı ?

Komplikasyonlar artmıyor

Sol portal ven hasarı riski var

Embolizasyon materyali segment 2-3 dallarına ilerleyebilir

Deneyim

Yeterli kant ?

Çalışmalardaki hasta sayısı sınırlı

**Two-Stage Hepatectomy: A Planned Strategy to Treat Irresectable Liver Tumors**

Induction of liver hypertrophy for extended liver surgery and partial liver transplantation: State of the art of parenchyma augmentation-assisted liver surgery

**PVE/patektomiPVL + iki aşamalı hepatektomi**

**Hepatektomi: %60-100**

**FLR hipertrofisi: %30-60**

**Morbidite: %20-59**

**Mortalite: 0-%15**

**Sağkalım**

3 yıl: %33-84

5 yıl: 32-64

Reference	Year	Patients (n)	PVE/PVL (%)	Volume increase* (%)	Time* (d)	Resection rate (%)	Morbidity (%)	Mortality (%)
Adam et al. [42]	2000	16	44	-	120	81	38	15
Jack et al. [43]	2004	33	100	31	-	76	56	0
Tanaka et al. [44]	2007	22	73	50	-	100	23	0
Wicherts et al. [49]	2008	59	78	-	126	69	59	7
Homayounfar et al. [50]	2009	24	100	36	55	63	58	5
Tsai et al. [51]	2010	45	78	-	135	78	26	6
Bouquet et al. [52]	2011	65	70	-	56	72	49	6
Tsai et al. [53]	2011	38	95	-	87	87	33	0
Narita et al. [54]	2011	80	95	-	92	76	54	0
Muratore et al. [55]	2012	47	81	-	114	77	44	0
Turini et al. [56]	2012	42	100	-	72	71	20	6
Shindoh et al. [57]	2013	144	98	62	34	72	58	6
Fuks et al. [58]	2015	34	15	-	93	76	50	3
Panoss et al. [59]	2017	109	73	-	82	82	27	6

**PVE/PVL + iki aşamalı hepatektomi**

İyi hasta seçimi → İyi sağkalım

Limitasyonlar

- İki aşama arası interval
- Tümör progresyonu
- Hepatektomi yapılamaması (%80 tümör progresyonu, %20 yetersiz büyüme)

**İki aşama arasında kemoterapi ?**

KT → Progresyon riski azalır

Hipertrofi etkilenmez

Sağkalım daha iyi

In conclusion, a pathologic response to preoperative chemotherapy after the first-stage hepatectomy is associated with completion of the second surgical stage and with **longer survival**. The accurate

**ALPPS**

**Associating liver partition with portal vein ligation for staged hepatectomy**

İki aşamalı  
Hızlı hipertrofi  
Morbidite, mortalite

2012, Schnitzbauer et al.

Right Portal Vein Ligation Combined With In Situ Splitting Induces Rapid Left Lateral Liver Lobe Hypertrophy Enabling 2-Stage Extended Right Hepatic Resection in Small-for-Size Settings

Andreas A. Schnitzbauer MD<sup>1</sup>, Sven A. Lang MD<sup>2</sup>, Holger Goeppmann MD<sup>1</sup>, Silvio Nadalin MD<sup>3</sup>, Antje Baumgart MD<sup>1</sup>, Stefan A. Farkas MD<sup>4</sup>, Stefan Fichtner-Fuegl MD<sup>5</sup>, Thomas Loif MD<sup>6</sup>, Armin Gombalka MD<sup>7</sup>, Rüdiger Hübner MD<sup>8</sup>, Alexander Krenner MD<sup>9</sup>, Martin Lenz MD<sup>9</sup>, Felix Brömmel MD<sup>10</sup>, Marcus N. Schorr MD<sup>11</sup>, Winfried Pahlberg MD<sup>12</sup>, Alfred Klingenstein MD<sup>13</sup>, Heiko Lang MD<sup>14</sup>, Emma Obert MD<sup>15</sup> and Hans J. Schick MPP

**Associating liver partition and portal vein ligation for staged hepatectomy (ALPPS)**

**Stage 1**

Ligation of the portal vein + in situ split

Tumor resections from the remnant liver

1 week

**Stage 2**

Hypertrophy of the remnant liver

Resection of the deportalized liver

**ALPPS**

FLR volüm artışı (%61-93) (Hatta %110)

Hemen hemen **tüm hastalarda 2. aşama** gerçekleşiyor

2. aşama aynı aynı hospitalizasyonda

Morbidite: %53-90  
≥3B, %14-50

Mortalite: 0 - %28,7

**iki aşamalı hepatektomi vs ALPPS**

Tartışma devam ediyor

Postoperatif sonuçlar  
Onkolojik sonuçlar

İlk sonuçlara göre

**ALPPS ve iki aşamalı klasik cerrahi, onkolojik sonuçları benzer**  
**Morbidite, mortalite yüksek**

Ann Surg 2014; 260: 829-36  
World J Surg 2018; 42: 806-15

Induction of liver hypertrophy for extended liver surgery and partial liver transplantation: State of the art of parenchyma augmentation-assisted liver surgery

Philip C. Miller<sup>1</sup>, Michael Lindeker<sup>2</sup>, Ethan O. Mikina<sup>3</sup>, Christian E. Oberkofler<sup>4</sup>, Pierre-Alain Clavien<sup>1</sup>, Pascal Roth<sup>5</sup>, Henrik Palmreich<sup>6</sup>

**Table 3** Comparative studies evaluating patient outcomes for PVE and ALPPS

Reference	Year	Study design	Strategy	Patients (n)	Volume increase* (%)	Time† (d)	Resection rate (%)
Knoefel et al. [70]	2012	RCS	ALPPS	7	63	8	100
			PVE	15	37	35	80
Tanaka et al. [83]	2015	RCS	ALPPS	10	54	-	-
			PVE	54	19	-	-
Croome et al. [71]	2015	RCS	ALPPS	15	84 <sup>99</sup>	8	100
			PVE	53	36 <sup>99</sup>	40	79
Schadde et al. [82]	2015	RCS	ALPPS	320	47	14	98
Ram et al. [84]	2015	RCS	ALPPS	12	47	11	100
			PVE/PVL	36	41	31	94
Chia et al. [72]	2017	RCS	ALPPS	10	48	-	80
			PVE/PVL	29	12	46	59
Sandström et al. [73]	2018	RCT	ALPPS	48	68	11	92
			PVE/PVL	49	36	43	57
Chan et al. [95]	2019	RCS	ALPPS	46	48	7	98
			PVE	102	38	48	68

Early Survival and Safety of ALPPS  
First Report of the International ALPPS Registry

**TABLE 3.** Main Postoperative Outcomes of 202 Patients in the ALPPS Registry

Variable	All Patients (n = 202)
Failure to reach stage II, n (%)	5 (2)
30-d mortality, n (%)	5 (2)
In-hospital mortality, n (%)	18 (9)
90-d mortality	19 (9)
In all patients n (%)	
In CRLM, n (%) (no. total CRLM)	11 (8%) (n = 141)
In IHCC, n (%) (no. total IHCC)	2 (12%) (n = 17)
In FHCC, n (%) (no. total FHCC)	3 (27%) (n = 11)
In IHCC, n (%) (no. total IHCC)	1 (13%) (n = 8)
In NET, n (%) (no. total NET)	0 (0%) (n = 8)
In gallbladder cancer (%) (no. total gallbladder cancer)	2 (33%) (n = 6)
In subgroup ≤60 yr + CRLM, n (%) (no. total)	4 (5.1%) (n = 78)
Highest complication: ≥grade IIIa in both stages	
All patients, n (%) (no. total)	80 (40%) (n = 202)
In CRLM group, n (%) (no. total)	51 (36%) (n = 141)
In subgroup ≤60 yr + CRLM, n (%) (no. total)	23 (29%) (n = 78)
Highest complication: ≥grade IIIb in both stages	
All tumor types, n (%)	56 (28%) (n = 202)
In CRLM group, n (%) (no. total)	30 (21%) (n = 141)
In subgroup ≤60 yr + CRLM, n (%) (no. total)	12 (16%) (n = 78)

Preparing for liver surgery with "Alphabet Soup": PVE, ALPPS, TAE-PVE, LVD and RL

Duohee Kim<sup>1</sup>, Julius Ceremano-Himmelfart<sup>2</sup>, David C. Madoff<sup>3</sup>

*HepatoBiliary Surg Nutr* 2020;9(2):136-151

**Table 2** Summary of meta-analysis and systematic reviews on ALPPS

Author, Year	Type	# included patients	FLR increase (%)	Rates of complete ALPPS (%)	Morbidity (%) (> Clavien-Dindo 3a)	Mortality (%)	Remarks
Schnitzbauer et al., 2012 (85)	Retrospective cohort study	25	74 (RH)	100	44	12 (during index admission)	
Knoefel et al., 2013 (86)	Prospective cohort study	7	63 (RH)	100	71.4	14.3 (7 days)	
Nastalin et al., 2014 (70)	Retrospective cohort study	15	87.2 (RH)	100	66.7	28.7 (within 30 days)	
Schadde et al., 2014 (86)	Prospective cohort study	202	80 (RH)	98	40	9 (90 days)	Age <60, CRLM group with better survival
Sandstrom et al., 2018 (87)	Randomized controlled trial	48	68 (RH)	92	43	9 (90 days)	

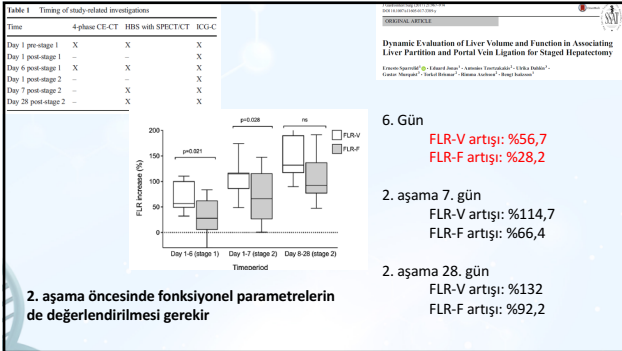
High mortality after ALPPS for perihilar cholangiocarcinoma: case-control analysis including the first series from the international ALPPS registry

Pim B. Othof<sup>1</sup>, Robert J.S. Coelen<sup>1</sup>, Jimme K. Wiggers<sup>1</sup>, Bas Groot Koerkamp<sup>2</sup>, Massimo

**Discussion**—Outcomes of ALPPS for PHC appear inferior when compared to standard extended resections in high-risk patients. Considering these outcomes, portal vein embolization should remain the preferred method to increase future remnant liver volume in PHC patients.

**ALPPS is not recommended for PHC due to the 48% 90-day mortality in expert centers**

Morbidity ?  
Mortalite ?



**Histologic features after surgery associating liver partition and portal vein ligation for staged hepatectomy versus those after hepatectomy with portal vein embolization**  
*(Surgery 2016;159:1289-98.)*

**ALPPS grubunda hepatositler daha immatür**

**FLR'de fonksiyonel artışın da dikkate alınmalı**

**Immaturity of Bile Canaliculo-Ductule Networks in the Future Liver Remnant While Associating Liver Partition and Portal Vein Occlusion for Staged Hepatectomy (ALPPS)**

Researcher: Yasunori Miyajima, MD, PhD; Yusaku Hirabayashi, MD, PhD; Kazuo Yamashita, MD, PhD; Akira Kuroda, MD, PhD; Yuzuru Kikuchi, MD, PhD; Takanori Kawaguchi, MD, PhD; Takashi Morikami, MD, PhD; Yoon-Ho Jang, MD, PhD; and Kenji Yamada, MD, PhD

**ALPPS Modifikasyonları**

**Minör**  
 Karaciğerin emilebilir materyal ile sarılması  
 Anterior yaklaşım  
 MHV'nin korunması

**Majör**

**Associated Liver Partition and Portal Vein Ligation for Staged Hepatectomy (ALPPS) Registry: What Have We Learned?**

Wenke Lang, Jochen Burghardt, and Jens Miller  
 Professor of General, Visceral and Transplant Surgery University Medical Center, Mainz, Germany

**Optimization of the future remnant liver: review of the current strategies in Europe**

**Table 2** Different types of ALPPS procedures

Type	Technique description on stage 1
Classic ALPPS (60)	Complete parenchymal transection, portal vein ligation
Partial ALPPS (61)	Partial parenchymal transection, portal vein ligation
RALPPS (62)	Radiofrequency ablation of the ideal transection line, portal vein ligation
Mini ALPPS (63)	Partial parenchymal transection, portal vein embolization (via inferior mesenteric vein)
Partial TIPE ALPPS (64)	Partial parenchymal transection, portal vein embolization (via iliohepatic approach)
Anterior approach ALPPS (65)	Complete parenchymal transection using anterior approach, down to IVC. No liver mobilization
Hybrid ALPPS (66)	Complete parenchymal transection with anterior approach, PVE between two stages
ALPPS (67)	Application of tourniquet around the parenchymal transection line, portal vein ligation
Modified ALPPS with preservation of portal pedicles (68)	Complete parenchymal transection, selectively preserving portal pedicles
Salvage ALPPS (69)	Splitting of the liver along the main portal fissure after months from a radiological portal vein embolization
Left ALPPS (70)	Splitting along the main portal fissure. Left portal vein ligation
Right ALPPS (70)	Left lateral sectionectomy, multiple resections on the left medial, right anterior section and caudate lobe. Ligation of the posterolateral branch of the right portal vein

**Performance validation of the ALPPS risk model**

Michael Linecker<sup>1</sup>, Christoph Kuehmerli<sup>1</sup>, Patryk Kambakamba<sup>1</sup>, Andrea Schlegel<sup>1</sup>, Paolo Muesari<sup>1</sup>, Ivan Capobianco<sup>1</sup>, Silvio Nadalin<sup>1</sup>, Orlando J. Torres<sup>1</sup>, Arshabh Mehra<sup>1</sup>, Gregor A. Stavrou<sup>1,2</sup>, Karl J. Gohlander<sup>1</sup>, Georg Lunge<sup>1</sup>, Deniz Bakir<sup>1</sup>, Haasek Lang<sup>1</sup>, Ricardo Robles-Campos<sup>1</sup>, Roberto Hernandez-Alejandre<sup>1,3,4</sup>, Massimo Malago<sup>1,5</sup>, Eduardo De Santibanes<sup>1</sup>, Pierre-Alain Clavien<sup>1</sup>, & Henrik Petrowsky<sup>1</sup>

**HPB 2019, 21, 711-721**

**Table 1** ALPPS pre-stage 1 and pre-stage 2 risk score<sup>10</sup>

Risk points	Pre-stage 1 scores of 0, 1, 2, 3, 4, and 5 were associated with early mortality risk of 2.7%, 4.9%, 8.6%, 15%, 24%, and 37%.
<b>Pre-stage 1 variables</b>	
Tumor type	
CRLM (reference)	0
Non-CRLM, non-biliary	1
Biliary	2
Age ≥ 67 years	3
<b>Pre-stage 2 variables</b>	
Pre-stage 1 score, per point	0.66
Inter-stage complications ≥3b	1.2
Serum bilirubin pre-stage 2	1.5
Serum creatinine pre-stage 2	1.7

**Pre-stage 2 Score=**  
 $0.66 \times (\text{Pre-stage 1 score}) + 1.2 \times (\text{complications } \geq 3b; 0 = \text{complications } < 3b) + 1.5 \times \log_{10}(10 \times \text{bilirubin pre-stage 2 in mg/dL}) + 1.7 \times \log_{10}(10 \times \text{creatinine pre-stage 2 in mg/dL})$

**Mortality risk (%) = odds/(1 + odds)**  
 $\text{odds} = \exp(-6.9 + \text{pre-stage 2 risk score})$

**ALPPS Improves Resectability Compared With Conventional Two-stage Hepatectomy in Patients With Advanced Colorectal Liver Metastasis**  
*Results From a Scandinavian Multicenter Randomized Controlled Trial (LIGRO Trial)*

**ALPPS vs TSH (48 vs 49)**

**Rezektabilité: %92 (44) vs %57 (28)**

**Interval: 11 gün vs 43 gün**

**Majör komplikasyon: %43 vs %43**

**Mortalité: %8,3 (4) vs %6,1 (3)**

**Conclusion: ALPPS is superior to TSH in terms of RR, with comparable surgical margins, complications, and short-term mortality.**

**Table 1** Inclusion and Exclusion Criteria<sup>1</sup>

**Inclusion:**

- Patients with colorectal liver metastases regarding liver resection, not resectable in one step because of a future liver remnant/standardized total liver volume ratio of <50%, without any distant colorectal metastasis
- All patients should have been treated with preoperative chemotherapy within or out of the cancer multidisciplinary team
- Extrahepatic metastatic disease or unresected primary tumors are not inclusion criteria if they can be addressed surgically in the future

**Exclusion:**

- Chronic disease on preoperative chemotherapy
- Child-Pugh
- Significant comorbidity rendering subjects unsuitable for major surgery
- Age < 18 yrs

**6. ULUSAL CERRAHI ONKOLOJİ KONGRESİ**  
19-20 Eylül 2022 - İstanbul

**OS**

**ALPPS vs TSH**  
46 ay vs 26 ay (p<0,05)

**Rezeksiyon yapılanlarda**  
46 ay vs 39 ay (p>0,05)

**12 hasta: Rescue ALPPS**  
27 ay

**Conclusions:** ALPPS seems to improve survival in patients with CRLM and sFLR <30% compared with TSH.

**ALPPS Improves Survival Compared With TSH in Patients Affected of CRLM**  
Survival Analysis From the Randomized Controlled Trial LIGRO  
Kriszta Huszár, MD, PhD, BSc, MEd, PhD, Piro N. Lencsés, MD, PhD, Kriszta Huszár, MD, PhD, Gábor Zoltán, MD, PhD, Miklós A. Székely, MD, PhD, Béla A. Rónyai, MD, PhD, BSc, PhD, Attila Lindtner, MD, PhD, Miklós Rózsás, MD, PhD, BSc, PhD, György Bognár, MD, PhD, and Péter Szendrői, MD, PhD, FEBSC

*(Ann Surg 2021;273:442-448)*

**6. ULUSAL CERRAHI ONKOLOJİ KONGRESİ**  
19-20 Eylül 2022 - İstanbul

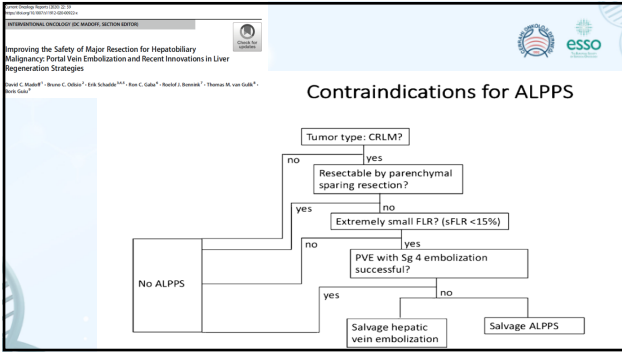
**Surgery**  
Liver Transplantation and Hepatectomy

**Survival after associating liver partition and portal vein ligation for staged hepatectomy (ALPPS) for advanced colorectal liver metastases: A case-matched comparison with palliative systemic therapy**  
In conclusion, this analysis shows that in this voluntary registry of ALPPS procedure up to one third of ALPPS procedure for CRLM may well be performed without an objective indication to perform a two-stage hepatectomy rather than a one-stage right hepatectomy. Not surprisingly, surgical outcomes were relatively good in this patient population.

**Overuse ???**

For patients with advanced CRLM and no other operative option other than ALPPS, the current results suggest that other treatment modalities, including systemic therapy, might be superior.

*(Ann Surg 2021;273:442-448)*



**6. ULUSAL CERRAHI ONKOLOJİ KONGRESİ**  
19-20 Eylül 2022 - İstanbul

**First Long-term Oncologic Results of the ALPPS Procedure in a Large Cohort of Patients With Colorectal Liver Metastases**  
Hervé Péroche, MD, BSc, Michael Lencsés, MD, PhD, Dániel A. Rónyai, MD, PhD, Christoph Arentz, MD, Ralph Fricke, MD, Oscar E. Azzouti, MD, David Balci, MD, Francesco Ratti, MD, Luca Aldighetti, MD, Sergio Valdearcos, MD, Federico Franceschi, MD, Roberto J. Trivek, MD, Jan Röhrich, MD, Georg Lunge, MD, Mehmet Emin Fıratlıoğlu, MD, Tom Beyer, MD, Karim J. Ghali, MD, Stéphanie Prasse, MD, Françoise Rose, MD, Enzo Ratti, MD, Patrick Kambhampati, MD, Françoise Rose, MD, Silvio Nalin, MD, Eduardo S. M. Fernandes, MD, Philip Koon, MD, Peter Luder, MD, Pawel Ostojka, MD, Maria van Gulik, MD, Carlos Cervera-Rivero, MD, Pedro Ribeiro, MD, Marco A. Machado, MD, Martin Frenk, MD, Jan J. M., Marco N. Schreyer, MD, Hans J. Schm., Victoria Andújar, MD, Eduardo de Sãothaber, MD, Roberto Bruchini, MD, Victor Lopez-Lopez, MD, Ricardo Robles Campes, MD, Massimo Malpica, MD, Roberto Hernandez-Alexandre, MD, and Pierre-Alain Clavien, MD, PhD.

*(Ann Surg 2020;272:793-800)*

**2009-2019**  
**22 merkez**  
**510 hasta**

**%96 hepatektomi**  
**Median takip: 38 ay**

**90 gün mortalite: %5**

**Komplikasyon (≥3)**  
**kanser spesifik sağkalım (KSS): 45 ay → 31 ay**

**Kemoterapiye tam veya parsiyel cevap → 51 ay**  
**Kemoterapi altında stabil veya progresyon → 30 ay**

**6. ULUSAL CERRAHI ONKOLOJİ KONGRESİ**  
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*(Ann Surg 2020;272:793-800)*

**Median KSS: 42 ay**  
**Median OS: 37 ay**

**Median rekürrensiz sağkalım (RFS): 11 ay**

**3 yıl**  
KSS: %59, OS: %52, RFS: %19

**5 yıl**  
KSS: %33, OS: 27, RFS: %12

**Tümör biyolojisi iyi olan hastalarda Kemoterapiye iyi cevap veren hastalarda** → **İyi sağkalım**

**6. ULUSAL CERRAHI ONKOLOJİ KONGRESİ**  
19-20 Eylül 2022 - İstanbul

**ALPPS**

**Yüksek rezeksiyon oranı → Sağkalım ?**

**Morbidite, mortalite daha yüksek**

**Çok iyi hasta seçimi gerekli**

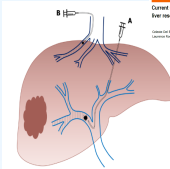
**İnterval kısa**  
Tümör biyolojisi değerlendirilemeyebilir  
Mikrometastazlar tespit edilemeyebilir  
Erken rekürrens ve düşük DFS bildiren yayınlar var  
(World J surg 2014; 38: 1504-9)  
(Br J Surg 2016; 103: 1521-29)



**6. Ulusal CERRAHI ONKOLOJİ KONGRESİ**

**LVD (PVE + HVE)**

LVD (Liver venous deprivation)  
 PVE + Hepatik ven embolizasyonu (PVE/HVE, TurboPVE, bi-embolization, RASPE)



Current strategies to induce liver venous hypertrophy before major liver resection

**Hızlı hipertrofi**  
**Hem hipertrofi hem de rejenerasyon hızı açısından ALPPS ile benzer sonuçlar ?**

**6. Ulusal CERRAHI ONKOLOJİ KONGRESİ**

**LDLT deneyimi**

Hepatik konjesyon karaciğer rejenerasyonunu bozar

↓

Atrofi

Mekanizma ??

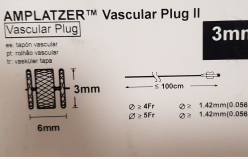
Hepatik arter akımı (arteriyel tampon) azalır  
 PVE sonrası oluşabilecek portovenöz kollateral gelişimi ortadan kaldırır

↓

Hızlı volüm artışı

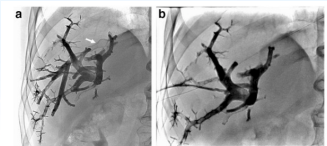
**LVD**

rPVE (NBCA/Lipiodol) (Segment 4 -)  
 RHV oklüzyonu (AVP ile)  
 Küçük hepatic venlerin oklüzyonu (NBCA/lipiodol)



**eLVD**

rPVE + RHV + MHV



Sequential Preoperative Ipsilateral Hepatic Vein Embolization After Portal Vein Embolization to Induce Further Liver Regeneration in Patients With Hepatobiliary Malignancy

*Ann Surg 2009;249: 608-616*

	FLR Volume (mL)	FLR Volume/TLV (%)
Before PVE	561.1 ± 43.1	34.8 ± 1.6
1-2 wk after PVE	640.6 ± 53.5	39.7 ± 0.6
2 wk after HVE	714.8 ± 61.1	44.2 ± 1.1
1 wk after hepatectomy	1043.9 ± 149.5	64.5 ± 6.2

2016

23. Gün

FLR %28 → %41

Simultaneous trans-hepatic portal and hepatic vein embolization before major hepatectomy: the liver venous deprivation technique

**2021'e kadar toplam 8 seri**  
**En az 6 en çok 37 hasta**  
**Toplam 132 hasta**

Author	Patients	Time between embolization and surgery (days)	Planned/actual hepatic vein embolization (PVE/HVE) n	Resection (n)	Resection R0 n (%)	Postoperative complications: PVE/HVE (Stroke-Clotting)	PIE/FA	Mortality n
Goto et al. [15]	7	23 (range 13-30)	Exc. right HE: 6	67 (85%)	58 (87%)	Overall: 1 (15%) Major: 1 (15%)	0	Stroke: 1
Goto et al. [25]	10	31 (range 22-45)	Right HE: 1 Exc. right HE: 4 Exc. right HE + S: 2 Exc. right HE + S + 4	938 (90%)	938 (90%)	Overall: 2 (2%) Major: 1 (1%)	0**	90 day: 0
Le Roy et al. [26]	7	49 (OR: 20-210)	Exc. right HE: 6 Exc. right HE: 3*	67 (85%)	68 (100%)	Overall: 4 (6%) Major: 2 (3%)	0**	90 day: 1
Hocquet et al. [27]	6	21	Exc. right HE + S: 1* Exc. right HE + S + 4: 4	48 (80%)	36 (75%)	Overall: 0 (0%) Major: 0 (0%)	2**	90 day: 0
Passaro et al. [28]	13	38	Exc. right HE: 11 Right HE: 1	13 (100%)	n.s.	Overall: 0 (0%) Major: 0 (0%)	0*	n.s.
Kobayashi et al. [29]	21*	35 (OR: 23-109)	Exc. right HE: 9 Exc. right HE: 11 Exc. right HE + S: 1 Exc. right HE + S + 4: 9 ALPPS: 2*	2021 (95%)	n.s.	Overall: 11 (5%) Major: 0 (0%)	n.s.	0*
Le Roy et al. [30]	31	n.s.	Exc. right HE: 8 Exc. right HE: 11 Exc. right HE + S: 1 Exc. right HE + S + 4: 9 ALPPS: 2*	2531 (81%)	n.s.	Overall: 11 (4%) Major: 0 (0%)	n.s.	90 day: 3
Laurent et al. [31]	37*	36 (range 16-47)	Exc. right HE: 22 Right HE: 15	3237 (88%)	3132 (97%)	Overall: 32 (10%) Major: 0 (0%)	0	n.s.

**6. Ulusal CERRAHI ONKOLOJİ KONGRESİ**

**Table 3. Volumetric data of PVE/HVE in all published series**

Author	FLR (preintervention) PVE/HVE	Time between embolization and imaging (days)	FLR (postintervention) PVE/HVE	Percent hypertrophy	Degree of hypertrophy	KGR
Goto et al. [15]	28.2% FLR (range 23.4-33.3)	23 (range 13-30)	40.9% FLR (range 33.6-49.3)	n.s.	12.7% FLR	4.2% aFLR/week
Goto et al. [25]	20.8% aFLR (SD ± 5.1)	7	31.8% aFLR (SD ± 8.2) 33.4% aFLR (SD ± 7.2) 33.4% aFLR (SD ± 6.7)	53.4%* 62.5%* 63.3%*	n.s.	7.6 cc/day (SD ± 2.4)* 0.9 cc/day (SD ± 0.5)* 8.1 cc/day (SD ± 1.3)*
Le Roy et al. [26]	21% FLR (OR: 14-37)	22 (OR: 19-28)	39% FLR (OR: 25-47)	52.4% (absolute FLR) (OR: 19-188)	n.s.	n.s.
Hocquet et al. [27]	30.3% FLR (OR: 23-35.5)	23.5 (OR: 13-29)	42.3% FLR (OR: 34-47) 58% aFLR (OR: 54-71)	67% FLR (OR: 26-121)	n.s.	n.s.
Passaro et al. [28]	31.2% FLR (SD ± 6.5)	21	39% FLR (SD ± 7.9%) 40.8% FLR (OR: 31-40)	n.s.	n.s.	16 cc/day (SD ± 4.7)
Kobayashi et al. [29]	29% aFLR (OR: 23-31)	22 (OR: 17-30)	36% aFLR (OR: 23-54)	35% FLR (SD ± 2.6) 51.2% (CI 41.6-62.2)	8.9% FLR (OR: 6.7-12.8)	2.9% FLR/week (OR: 1.9-4.3)
Le Roy et al. [30]	22.5% FLR (CI 262-478)	26	39.8% FLR (range 30.64-52.92)	51.1% FLR (range 18-20)	10% (SD ± 6)	n.s.
Laurent et al. [31]	22.5% FLR (range 16.56-32.15)	31 (± 2)	39.8% FLR (range 30.64-52.92)	51.1% FLR (range 18-20)	n.s.	n.s.

**LVD**

%100 başarılı işlem  
 Komplikasyonlar artmıyor  
 Karaciğer nekrozu yok (Hafif transaminaz yüksekliği)  
 16 hastada progresyon  
 1 hastada yetersiz hipertrofi  
 115 hastaya rezeksiyon (%87)  
 PVE vs LVD  
 İnterval benzer  
 Rezeksiyon oranı benzer (hasta sayısı düşük)

**LVD**

Fonksiyonel volüm artışı ?

ALLPS → FLR-F artışı %28,2  
 eLVD → FLR-V artışı: %53,4  
 FLR-F artışı: %65,7

Extended Liver Venous Deprivation Leads to a Higher Increase in Liver Function that ALPPS in Early Assessment  
 A comment to: Sparrud, E. et al. Dynamic Evaluation of Liver Volume and Function in Assessing Liver Resection and Portal Vein Ligation for Staged Hepatectomy. *Journal of Gastrointestinal Surgery* (2017)

Emmanuel Desquesnes<sup>1,2</sup>, Erik Schalk<sup>3,4,5</sup>, Laurence Pinna<sup>6</sup>, François Queant<sup>7</sup>, Boris Galle<sup>8</sup>

**LVD**

Cerrahi sonrası komplikasyonlar  
 Morbidite: %68, (≥3: %1)  
 Mortalite: %5  
 Sadece PVE'ye göre morbidite ve mortalite artmıyor  
**Volüm artışı: PVE < LVD < ALPPS (yeterli veri ?)**  
 İki RKT devam ediyor (RKT, HYPER-LIVE01 trial, RKT, DRAGON trial)

**Transarteriyel kemoembolizasyon + PVE**

HCC → Majör rezeksiyonlar ?  
 PHLF  
 Kronik karaciğer hastalığı → Hipertrofi ?  
 PVE → Arteriyel akımda kompensatuar artış (tampon etki)  
 ↓  
 TACE + PVE  
 İskemi → Hızlı ve daha fazla hipertrofi

**TACE + PVE**

**Antitümöral etki, %50 iyi sonuçlar**  
 TACE + PVE → Sadece PVE'ye göre daha fazla hipertrofi  
 Sağkalım daha iyi (kanıt düzeyi ???)  
 TACE PVE arası interval: 30 gün

**TACE + PVE**

Induction of liver hypertrophy for extended liver surgery and partial liver transplantation: State of the art of parenchyma augmentation-assisted liver surgery  
 Philip C. Makin<sup>1</sup>, Michael Lindor<sup>2</sup>, Elise O. Sorensen<sup>3</sup>, Christian E. Oberlander<sup>4</sup>, Pierre-Alain Clavien<sup>5</sup>, David Ball<sup>6</sup>, Henrik Petrowsky<sup>7</sup>

**Table 1 Studies comparing patients undergoing TACE + PVE with PVE alone**

Reference	Study design	Year	Strategy	Patients (n)	Volume increase (%)	Time <sup>a</sup> (d)	Resection rate (%)
Aoki et al.[37]	RCS	2004	TACE + PVE	17	22	9 + 25	94
Ogata et al.[38]	RCS	2006	TACE + PVE	18	12	25 + 37	-
			PVE	18	8	40	-
Yoo et al.[35]	RCS	2011	TACE + PVE	71	7	36 + 29	96
			PVE	64	6	31	91
Peng et al.[36]**	RCS	2012	TACE + PVE	29	7	-	93
			PVE	25	8	-	76
Terawawa et al.[34]	RCS	2019	TACE + PVE	23	43	47 + 47	92
			PVE	28	31	48	68
Park et al.[39]	RCS	2020	TACE + PVE	109	18	75	-
			PVE	38	12	23	-

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**Radyasyon lobektomi**

Lobar embolizasyon (Y90)  
Teknik TARE'ye benzer  
Daha proksimalden uygulama, daha yüksek radyasyon dozu

Skar oluşumu, atrofi  
Portal akımın kontralateral loba yönelmesi  
Kontralateral hipertrofi

Hipertrofi daha az, daha yavaş (%20-50), daha uzun süreli  
Antitümöral etki, down staging (%40-70 iyi cevap)

Portal ven komponenti yok  
Portal ven trombozu varlığında uygulanabilir

Preparing for liver surgery with "Alphabet Soup": PVE, ALPPS, TAE-PVE, LYD and RI  
*HepatoBiliary Surg* (Nov 2020-9(2)):136-151  
Duffek KA, Johns Cerneau-Bronoff, David C, Nadeff

**Neoadjuvant Radiation Lobectomy As an Alternative to Portal Vein Embolization in Hepatocellular Carcinoma**  
Alford GM, MCD, Prasad-Pillay S, Sankar N, Mudd, MD, MS, Abbas-Farouk, MD, Rajak J, Lovvick, MD, and Paul Soren, MD, MEd

**Table 1 Summary of publications on portal vein embolization**

Author	Year	Patients	Tumor Type	Procedure	Time	Class	#	Thrombotic Complications	Follow-up	Degree of Hypertrophy
Wong	2006	79	HCC	Right	100 Gy	1	1	100%	12-24 months	37.2%
Chen	2008	33	HCC	Right	100 Gy	1	1	100%	12-24 months	41%
Wong	2009	34	HCC	Right	100 Gy	1	1	100%	12-24 months	47%
Chen	2010	34	HCC	Right	100 Gy	1	1	100%	12-24 months	47%
Chen	2011	34	HCC	Right	100 Gy	1	1	100%	12-24 months	47%
Chen	2012	34	HCC	Right	100 Gy	1	1	100%	12-24 months	47%
Chen	2013	34	HCC	Right	100 Gy	1	1	100%	12-24 months	47%
Chen	2014	34	HCC	Right	100 Gy	1	1	100%	12-24 months	47%
Chen	2015	34	HCC	Right	100 Gy	1	1	100%	12-24 months	47%
Chen	2016	34	HCC	Right	100 Gy	1	1	100%	12-24 months	47%
Chen	2017	34	HCC	Right	100 Gy	1	1	100%	12-24 months	47%
Chen	2018	34	HCC	Right	100 Gy	1	1	100%	12-24 months	47%
Chen	2019	34	HCC	Right	100 Gy	1	1	100%	12-24 months	47%
Chen	2020	34	HCC	Right	100 Gy	1	1	100%	12-24 months	47%

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**Radyasyon Lobektomi**

HCC

FLR hipertrofisi

Tümör nekrozu (lokal kontrol)

Biyolojik davranışın tespiti

Progresyonun önlenmesi

Cerrahi sonrası düşük rekürrens riski

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**A Novel Concept for Partial Liver Transplantation in Nonresectable Colorectal Liver Metastases**  
The RAPID Concept  
Full-Step Liver, MD, PhD<sup>1</sup>; Mervin Higgins, MD, PhD<sup>2</sup>; Indira Elamrani-Berrard, MD, PhD<sup>3</sup>; Alford GM, MD, PhD<sup>4</sup>; and Scott Chouhan, MD, PhD<sup>5</sup>  
(Ann Surg 2015;262:e49)

**RAPID**

Resection And Partial Liver Segment 2/3 Transplantation With Delayed Total Hepatectomy

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**Living donor liver transplantation with two-stage hepatectomy for patients with isolated, irresectable colorectal liver— the LIVER-TWJO-HEAL study**  
Full-Step Liver<sup>1</sup>, Scott Chouhan<sup>2</sup>, Mervin Higgins<sup>3</sup> and Indira Elamrani-Berrard<sup>4</sup>

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Özet

**PVE:** Orijinal teknik, standart teknik

Karşılaştırmalı çalışma çok az

Farklı yaklaşımlar

- Hızlı hipertrofi
- Sınırdaki hastalara rezeksiyon şansı
- Minimal invazif tedavi şansı
- Biyolojik test süresi