

AHPBA 2023

March 9 - 12, 2023

Loews Miami Beach Hotel, FL



AHPBA

Americas Hepato-Pancreato-Biliary Association



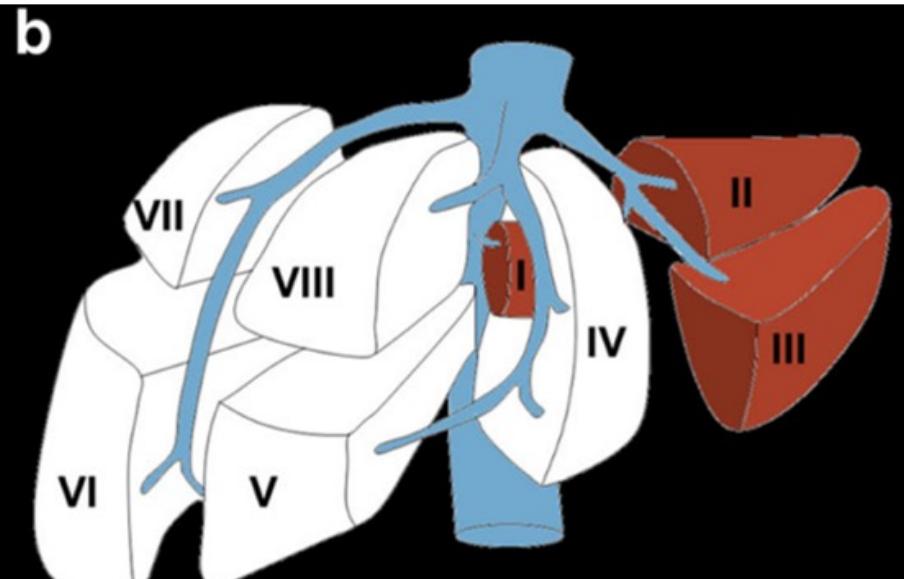
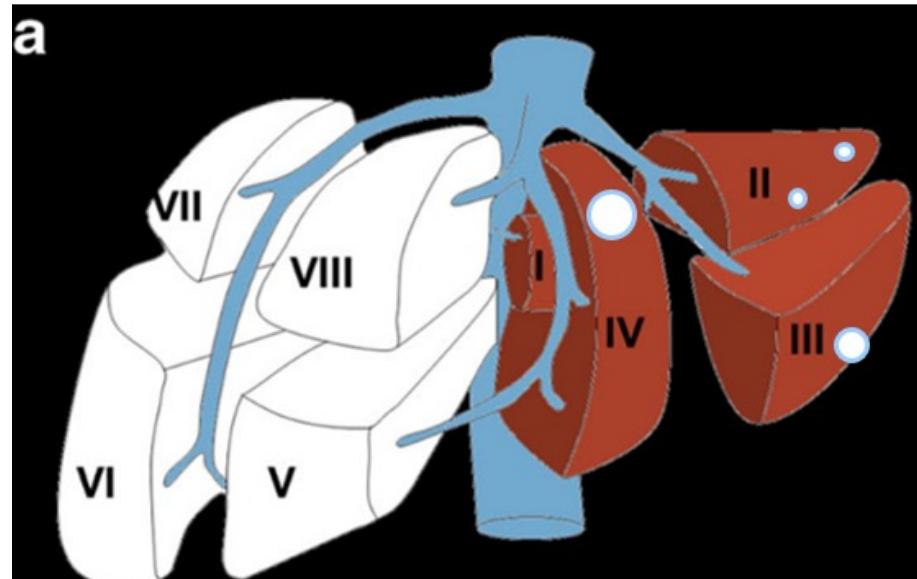
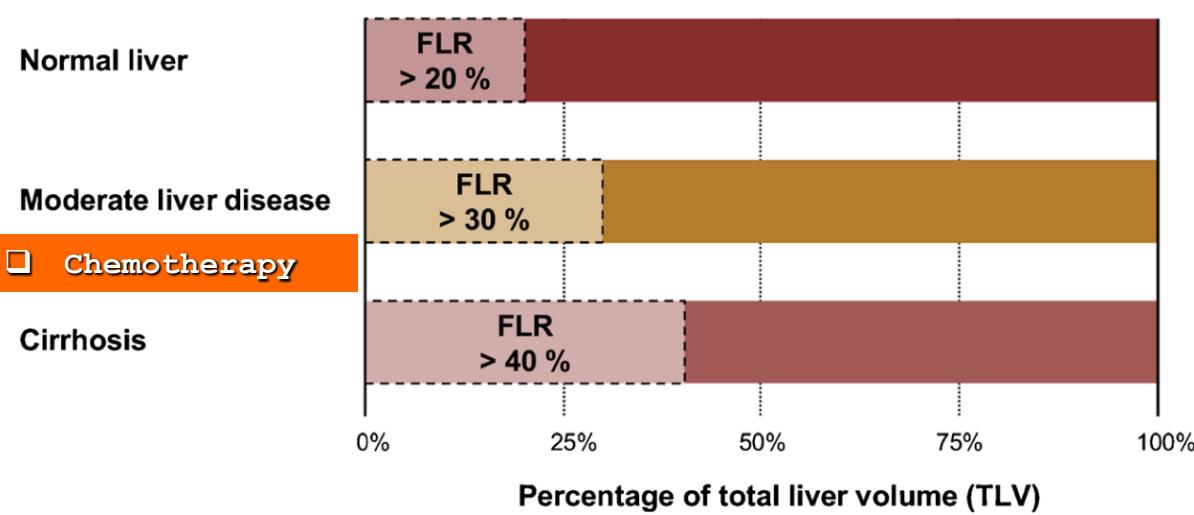
Colorectal Liver Metastases

PVE, HVE, ALPPS-Patient Selection and Outcomes

Orlando Jorge M. Torres MD, PhD

Full Professor and Chairman
Hepatopancreatobiliary Unit
Universidade Federal do Maranhão - Brazil

Patient selection

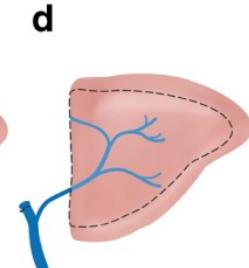
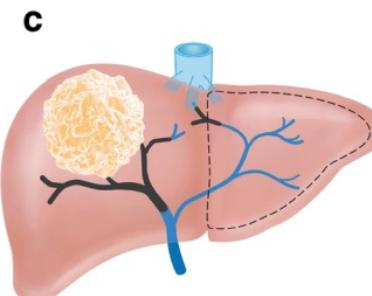
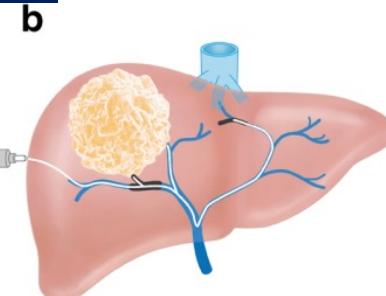
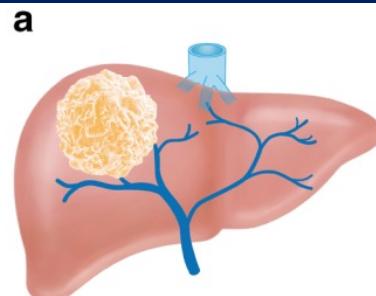


Right hepatectomy

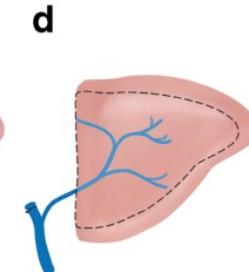
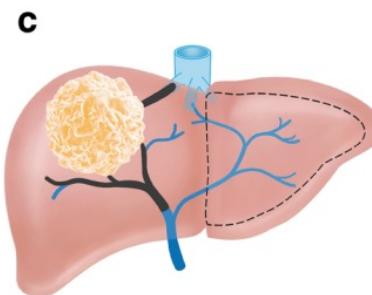
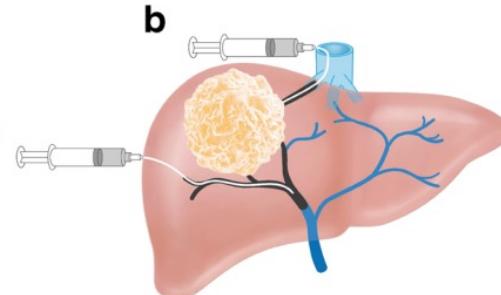
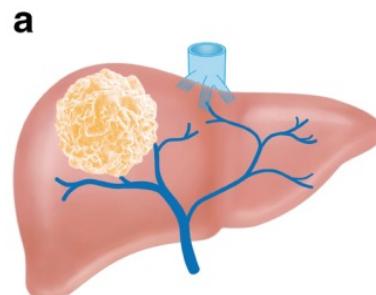
Extended right hepatectomy

Patient selection

Portal vein embolization

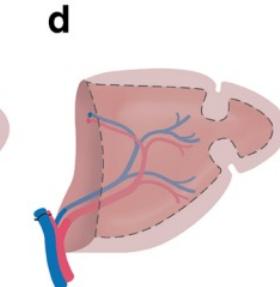
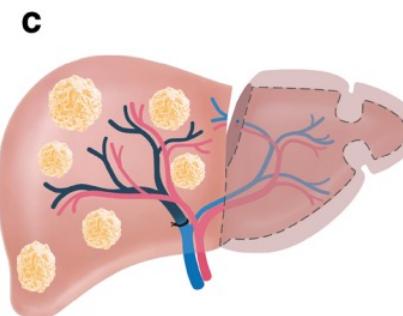
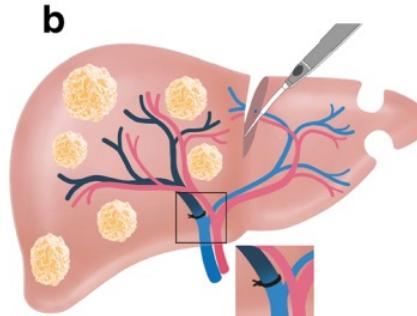
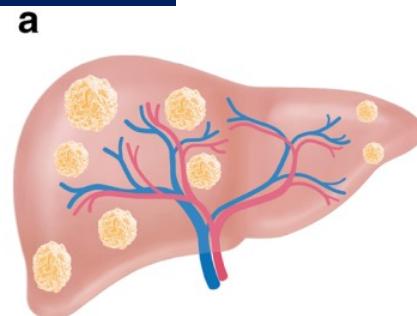


Liver venous deprivation



No tumor in the FLR

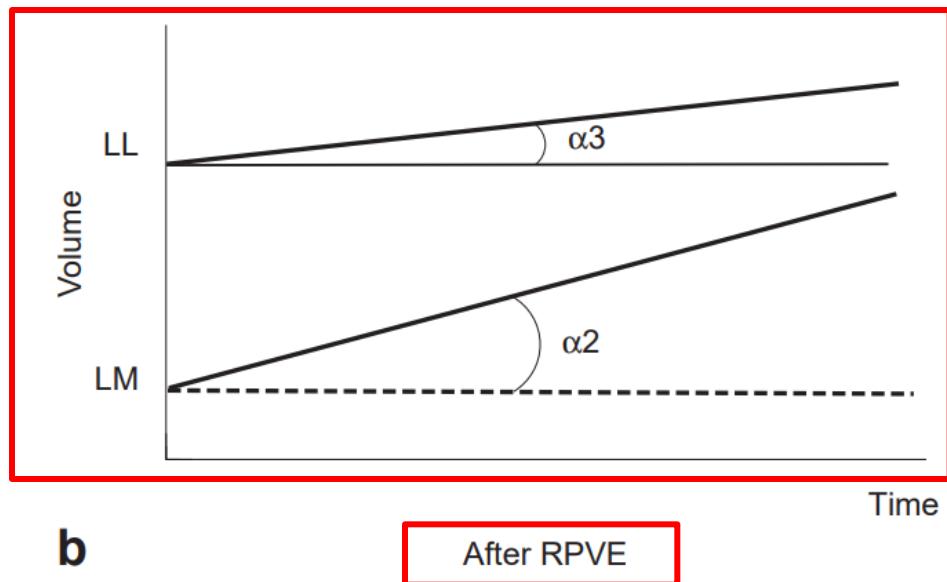
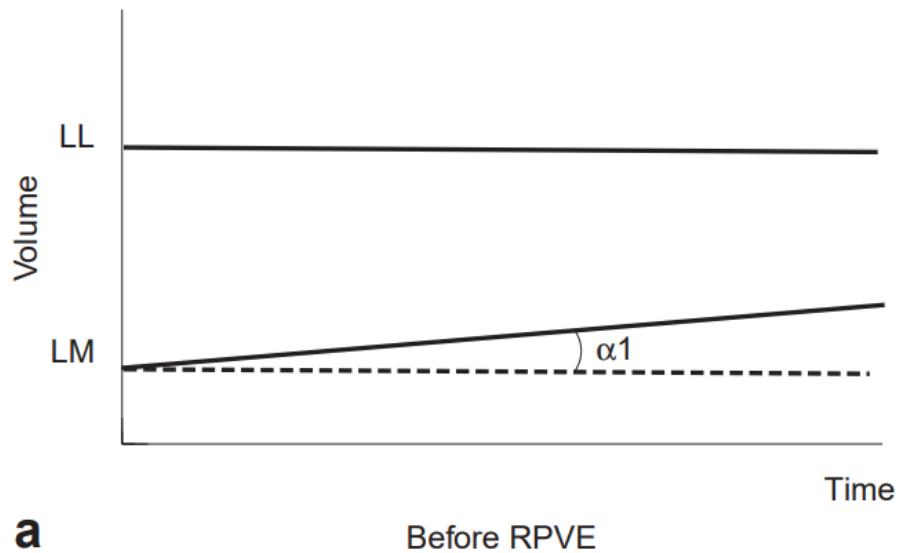
ALPPS



During liver regeneration following right portal embolization
the growth rate of liver metastases is more rapid than that of
the liver parenchyma

D. Elias, T. de Baere, A. Roche, M. Ducreux, J. Leclerc and P. Lasser

LL - Left lobe
LM - Liver mets



Volumetric increase

LL - Left lobe

59-127%

LM - Liver mets

60-970%



Patient selection

How should liver hypertrophy be stimulated? A comparison of upfront associating liver partition and portal vein ligation for staged hepatectomy (ALPPS) and portal vein embolization (PVE) with rescue possibility

□ Size of the FLR

Table 5 Successful resection rates for PVE depending on different sFLRs before PVE

Outcome	sFLR			
	<15%	15–20%	20.1–25%	>25%
Unsuccessful	4 (23.5)	7 (23.3)	8 (29.6)	8 (29.6)
Rescue ALPPS	7 (41.2)	8 (26.7)	3 (11.1)	0 (0)
PVE only	6 (35.3)	15 (50.0)	16 (59.3)	19 (70.4)

sFLR, standardized future liver remnant; PVE, portal vein embolization; ALPPS, associating liver partition and portal vein ligation for staged hepatectomy.

Preoperative Portal Vein Embolization for Liver Resection: An updated meta-analysis

Portal vein embolization

Feasibility of completion hepatectomy 76.3%

Table 1. Description of the 26 studies enrolled in the meta-analysis

Author	Year	Country	Inclusion period	Age	No. of patients	Resection patients	Interval between PVE and surgery
Okabe [46]	2011	Japan	1999-2009	58.8 (40-78)	24	19	28 (19-63)
Yamashita [2]	2013	Japan	1996-2009	61 (35-81)	64	49	NR
Shindoh [6]	2013	America	1995-2012	58 (24-86)	358	282	32 (5-385)
Fischman [37]	2014	America	2011-2013	59.9 (34-76)	35	27	41.6 (26-78)
Luz [41]	2017	Brazil	NR	56.5 (27-86)	50	31	NR
Alvarez [23]	2018	France	1993-2015	60 (24-86)	431	287	
Marti [24]	2017	America	2006-2014	61 (51.8-68)	82	69	
Tsurusaki [32]	2018	Japan	2010-2016	69.5 (45-86)	19	19	NR
Cotroneo [25]	2009	Italy	NR	66.2 (54-77)	31	24	NR
Giraudo [33]	2007	France	1997-2006	64 (44-88)	145	114	NR
Ribero [9]	2007	America	1995-2006	60 (36-78)	112	78	NR
Kakizawa [42]	2006	Japan	2001-2005	65 (35-81)	14	11	22 (14-37)
Beal [48]	2006	British	1999-2002	65 (52-74)	15	8	NR
Elias [16]	2001	France	1987-2000	NR	68	60	30 (24-65)
Madoff [36]	2003	America	1998-2001	59 (29-77)	26	16	NR
Jaberi [44]	2016	Canada	2008-2013	61.2 (38-84)	85	60	NR
Hemming [26]	2002	America	1996-2002	61 (31-82)	39	31	NR
Sofue [43]	2014	Japan	2007-2011	68 (45-82)	83	69	25 (14-55)
Geisel [38]	2013	Germany	2011-2012	NR	75	70	NR
Ratti [27]	2010	Italy	2006-2009	63 (37-82)	62	56	35 (13-57)
Radeleff [39]	2008	Germany	2001-2006	55 (31-68)	15	11	49 (34-72)
Cazejust [40]	2013	France	2009-2013	63 (38-80)	63	49	34 (28-49)
Kuo [17]	2012	Australia	1998-2007	60 (46-78)	25	19	36 (17-180)
Camelo [45]	2019	Portugal	2013-2017	64 (42-84)	64	44	NR
Loveday [28]	2018	America	2008-2015	61.8 (39-80)	31	23	8 (4-58)
Yamashita [29]	2017	Japan	1995-2013	63 (22-81)	319	256	NR

Resection rate 66.5%

Abbreviation: NOS: Newcastle-Ottawa Quality Assessment Scale Score; NR: not reported.

FEASIBILITY OF COMPLETION HEPATECTOMY

Resection rate

- PVE – 76.3% (Huang 2021)
- ALPPS – 98.4% (Schadde 2015)
- ALPPS – 100% (Hernandez-Alejandro 2014)
- ALPPS – 100% (Bjornsson 2015)
- ALPPS – 100% (Adam 2016)
- ALPPS – 100% (Herman 2014)

Segment 4

International Journal of Surgery 75 (2020) 60–65



Contents lists available at ScienceDirect

International Journal of Surgery

journal homepage: www.elsevier.com/locate/ijsu



Original Research

Segment 4 occlusion in portal vein embolization increase future liver remnant hypertrophy – A Scandinavian cohort study



Cardiovasc Intervent Radiol (2019) 42:552–559
<https://doi.org/10.1007/s00270-018-02159-5>



CLINICAL INVESTIGATION

VENOUS INTERVENTIONS

Segment 2/3 Hypertrophy is Greater When Right Portal Vein Embolisation is Extended to Segment 4 in Patients with Colorectal Liver Metastases: A Retrospective Cohort Study



CrossMark

Surg Radiol Anat
DOI 10.1007/s00276-016-1761-3

ORIGINAL ARTICLE

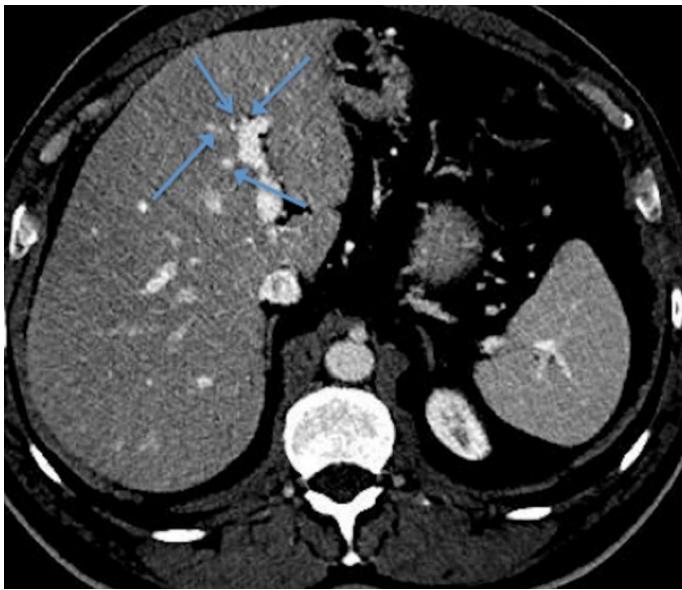
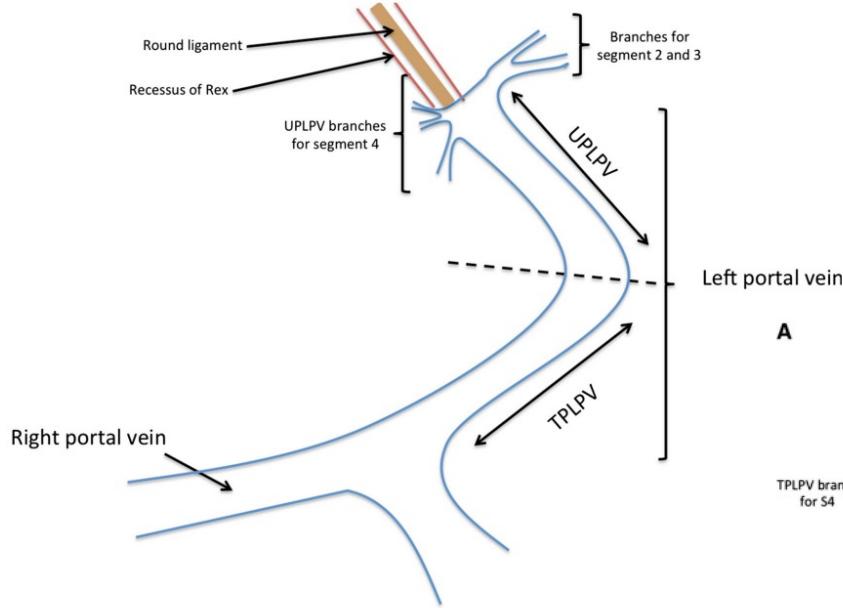
Portal supply of segment IV of the liver based on CT-scan

Greater degree of hypertrophy of segments 2/3.

Björnsson B, et al. Int J Surg 2020

Hammond CJ, et al. Cardiovasc Intervent Radiol (2019) 42:552–9

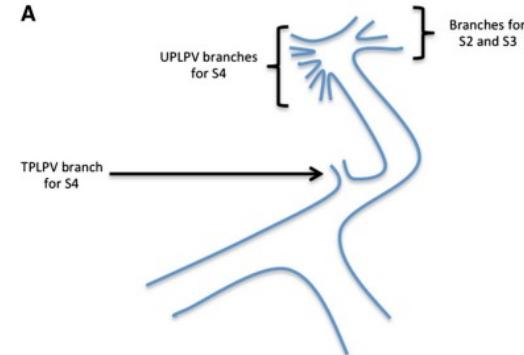
Maurer R, et al. Surg Radiol Anat 2016



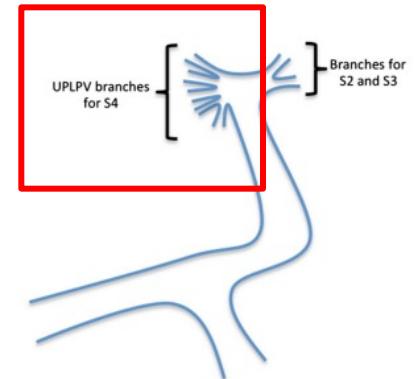
□ Segment 4

- 2-8 portal branches
- Embolization is challenging
- reproducibility questioned
- Thrombosis of the FLR (S2/S3)
- High number S4 - failure

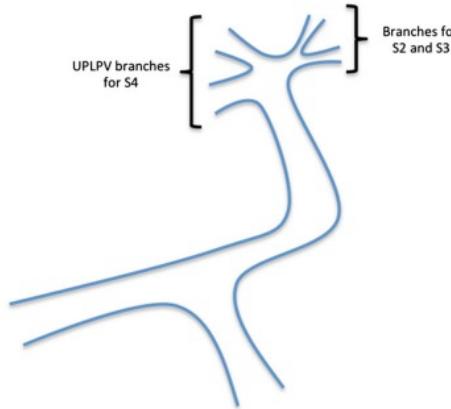
A



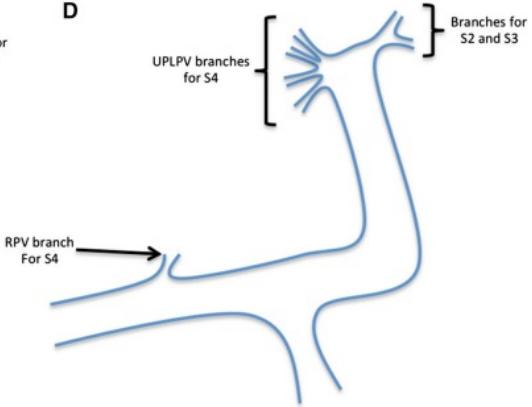
B



C



D



Patient selection

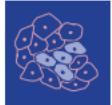
Article

Oncological Outcomes after Liver Venous Deprivation for Colorectal Liver Metastases: A Single Center Experience

Table 2. Liver volumes before and after liver venous deprivation (LVD). Median time between LVD and surgery was 39 days (IQR_{25–75} 25–56).

Liver Volumes	Before LVD	After LVD (7–10 Days Before Surgery)
Total Liver Volume (Median, IQR)	1803 mL (1496.5–2031)	2025 mL (1782–2191.5)
Future Liver Remnant Volume	451 mL (408.5–602)	761 mL (566–914)
% of FLR	29% (23.5–33)	39% (35.5–45.3)

Montpellier, France



Article

Oncological Outcomes after Liver Venous Deprivation for Colorectal Liver Metastases: A Single Center Experience





Liver Venous Deprivation Versus Portal Vein Embolization Before Major Hepatectomy for Colorectal Liver Metastases: A Retrospective Comparison of Short- and Medium-Term Outcomes

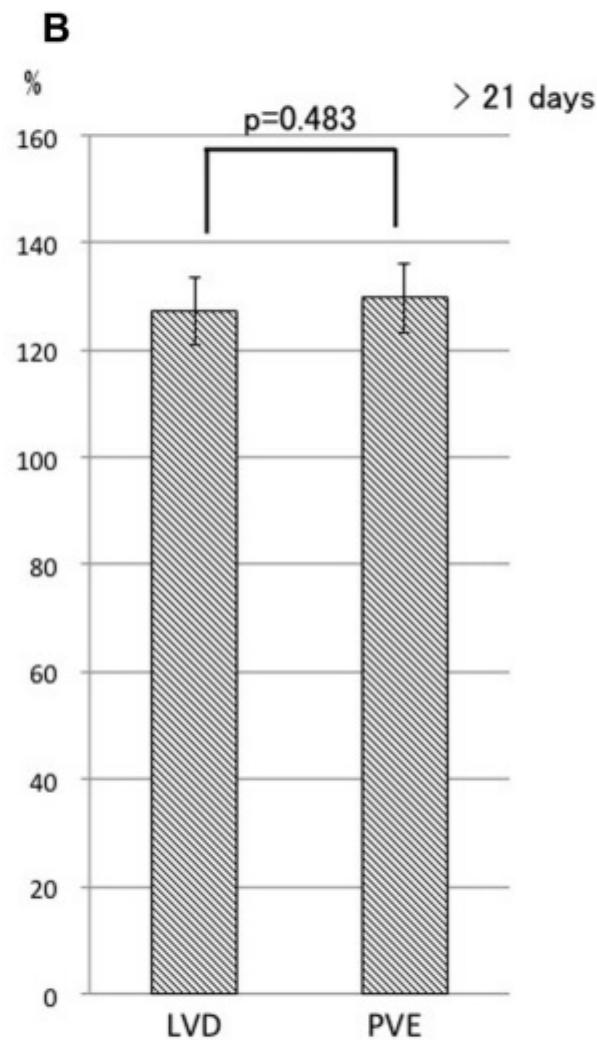
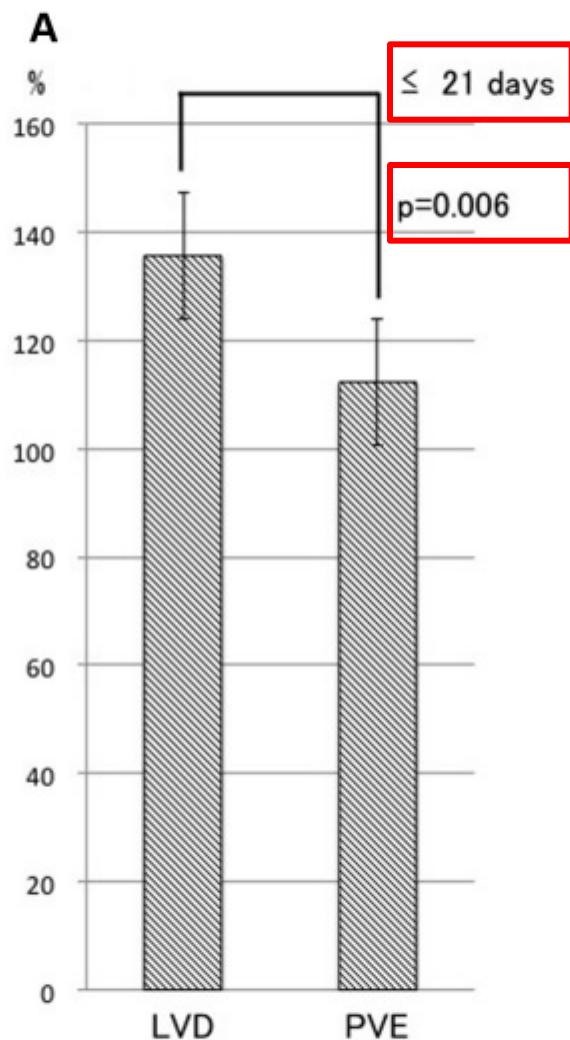
Table 3 Volumetric analysis

	LVD	PVE	p-value
Pre-procedural tumor volume, median (IQR _{25–75})	51 (35–121.5)	100 (34–154)	0.37
Pre-procedural FLR-V share %, mean (SD)	29.3 (6.8)	32.2 (9.7)	0.44
TLV gain in cc, mean (SD)	183 (271)	162 (303)	0.82
Pre-operative FLR-V %, mean (SD)	39 (9)	40.5 (11)	0.81
FLR-V increase %, mean (SD)	49 (29)	27 (18)	0.01
KGR % per day, mean (SD)	0.2 (0.2)	0.1 (0.1)	0.05
KGR in cc/day, mean (SD)	10 (8.7)	4.8 (4)	0.03
KGR % per week, mean (SD)	1.45 (1.3)	1.12 (1.1)	0.46

SD, standard deviations; IQR, interquartile range; TLV, total liver volume; FLR-V, future liver remnant volume; KGR, kinetic growth rate

Montpellier, France

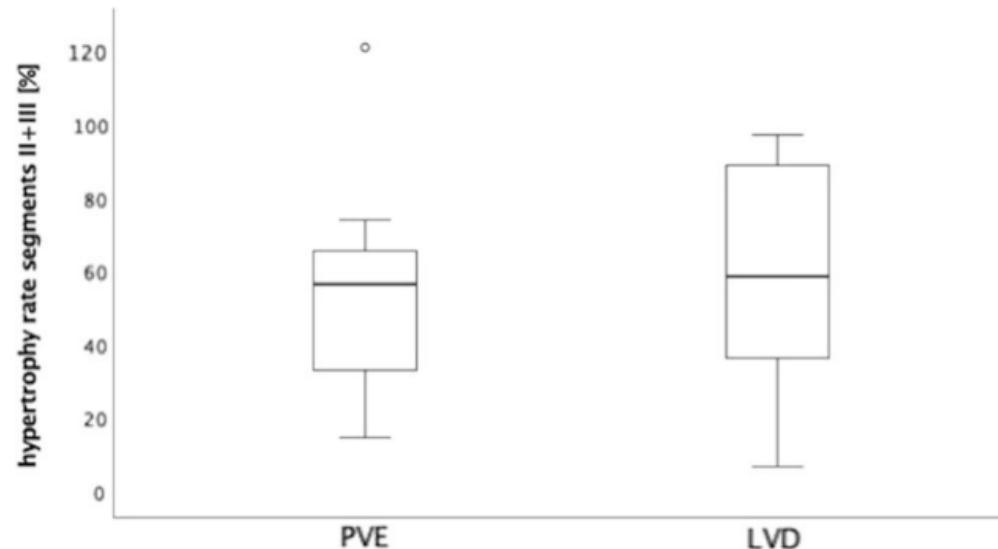
PVE vs LVD



Montpellier group? No

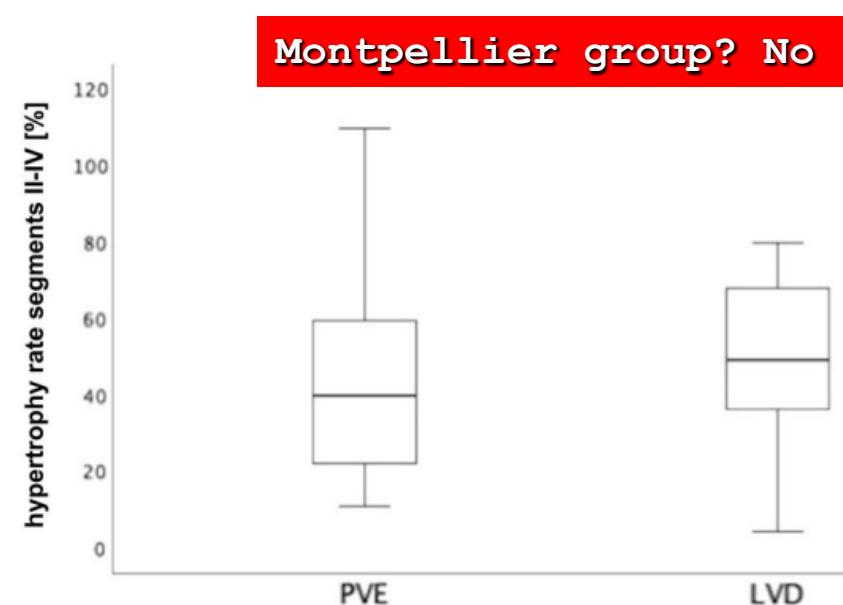
PVE vs LVD

Liver Venous Deprivation (LVD) Versus Portal Vein Embolization (PVE) Alone Prior to Extended Hepatectomy:
A Matched Pair Analysis



- Hypertrophy rate (II/III)
 - PVE $54.1 \pm 27.6\%$
 - LVD 59 ± 29.6

$P=0.637$



- Hypertrophy rate (II/III and IV)
 - PVE $44.9 \pm 28.9\%$
 - LVD 48.2 ± 22.2

$P=0.719$

Open Access



REVIEW

Regeneration rate

Treatment Effect

PVE vs ALPPS



LVD vs ALPPS



LVD vs PVE

Mean with 95%CI

-55.25 (-65.24,-45.27)

-43.26 (-64.47,-22.05)

11.99 (-6.70,30.69)

- ALPPS - higher regeneration rate than LVD/PVE
- LVD and PVE - no difference

Montpellier group? No

REVIEW

Open Access



Efficacy and safety of different options for liver regeneration of future liver remnant in patients with liver malignancies: a systematic review and network meta-analysis

Time to hepatectomy

Treatment Effect

PVE vs ALPPS



Mean with 95%CI

32.79 (22.66,42.92)

LVD vs ALPPS



34.02 (20.20,47.85)

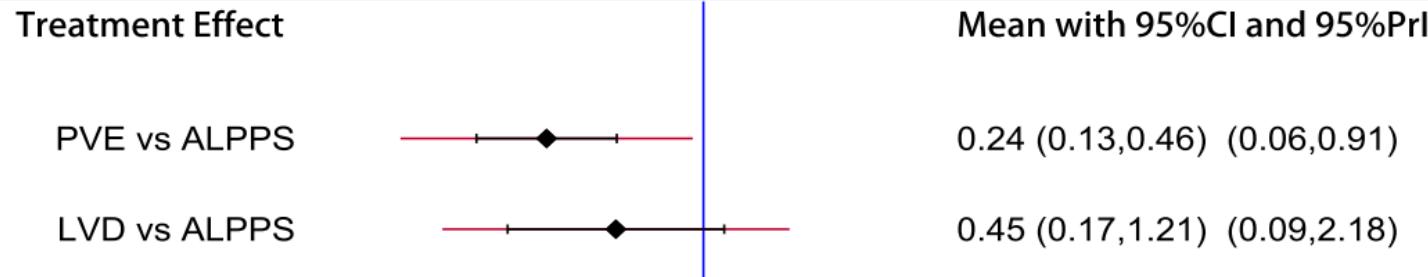
- ALPPS shorter than LVD/PVE
- LVD and PVE - no difference



Resection rate

REVIEW

Efficacy and safety of different options for liver regeneration of future liver remnant in patients with liver malignancies: a systematic review and network meta-analysis



- ALPPS - higher resection rate than PVE
- ALPPS and LVD - no difference
- LVD and PVE - no difference

REVIEW

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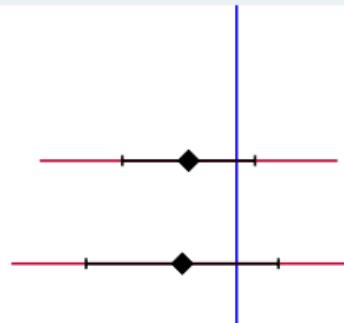


Efficacy and safety of different options for liver regeneration of future liver remnant in patients with liver malignancies: a systematic review and network meta-analysis

Clavien-Dindo \geq 3a complication rate

Treatment Effect

PVE vs ALPPS



Mean with 95%CI and 95%PrI

0.67 (0.39,1.17) (0.20,2.31)

LVD vs ALPPS

0.64 (0.29,1.42) (0.15,2.64)

- No significant difference
- ALPPS – trend of a higher Clavien-Dindo \geq 3a complication rate

First Long-term Oncologic Results of the ALPPS Procedure in a Large Cohort of Patients With Colorectal Liver Metastases

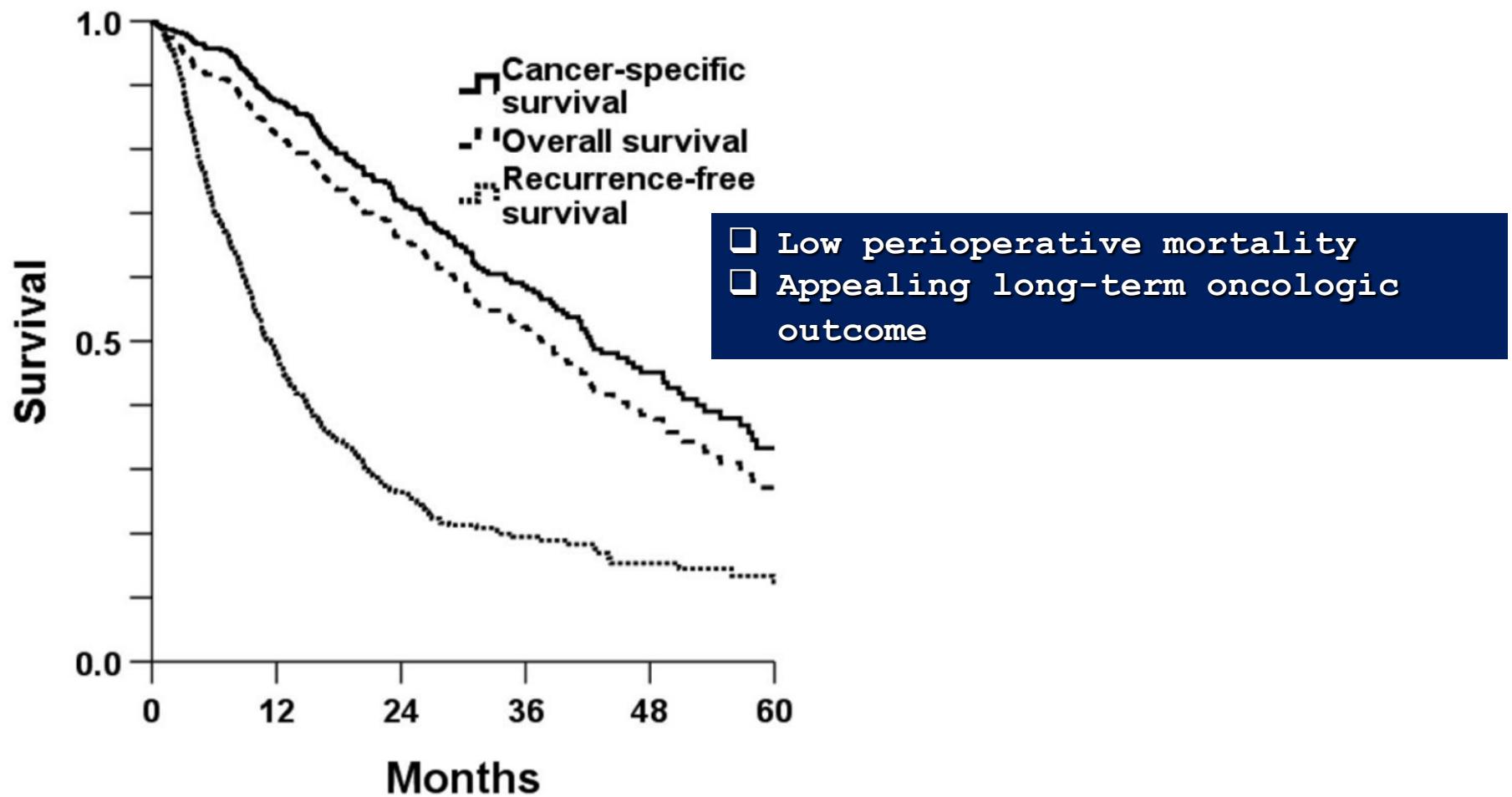


Table 1 Key modalities of the associating liver partition and portal vein ligation for staged hepatectomy technique

ALPPS strategies	Technical points
Classical ALPPS	Right portal vein ligation and right trisectionectomy
Rescue ALPPS	Failure of PVE with subsequent ALPPS
Laparoscopic ALPPS	Laparoscopy for stage 1 or both stages 1 and 2
PVE ALPPS	The intentional use of PVE as part of the first stage is stated by using PVE-ALPPS
Partial ALPPS	Transection at least 50% of the future transection plane at stage 1
Left ALPPS	Left portal vein ligation, left trisectionectomy
Tourniquet ALPPS	Tourniquet in the umbilical fissure and portal vein occlusion
Radiofrequency ALPPS	Radio-frequency-assisted liver partition
Microwave ALPPS	Microwave transection of the liver
Monosegment ALPPS	Extending hepatectomy, only sparing a single or adjacent segment

ORIGINAL ARTICLE

ALPPS as a salvage procedure after insufficient future liver remnant hypertrophy following portal vein occlusion

Rescue ALPPS

Lehwald-Tywuschik et al. *BMC Surgery* (2020) 20:63
<https://doi.org/10.1186/s12893-020-00721-y>

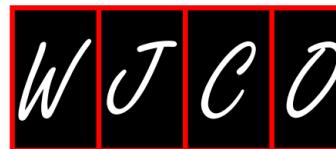
BMC Surgery

RESEARCH ARTICLE

Open Access



In situ split plus portal vein ligation (ISLT) – a salvage procedure following inefficient portal vein embolization to gain adequate future liver remnant volume prior to extended liver resection



World Journal of Clinical Oncology

Submit a Manuscript: <http://www.f6publishing.com>

DOI: 10.5306/wjco.v8.i4.351

World J Clin Oncol 2017 August 10; 8(4): 351-359

ISSN 2218-4333 (online)

ORIGINAL ARTICLE

Observational Study

Rescue associating liver partition and portal vein ligation for staged hepatectomy after portal embolization: Our experience and literature review

Alternative

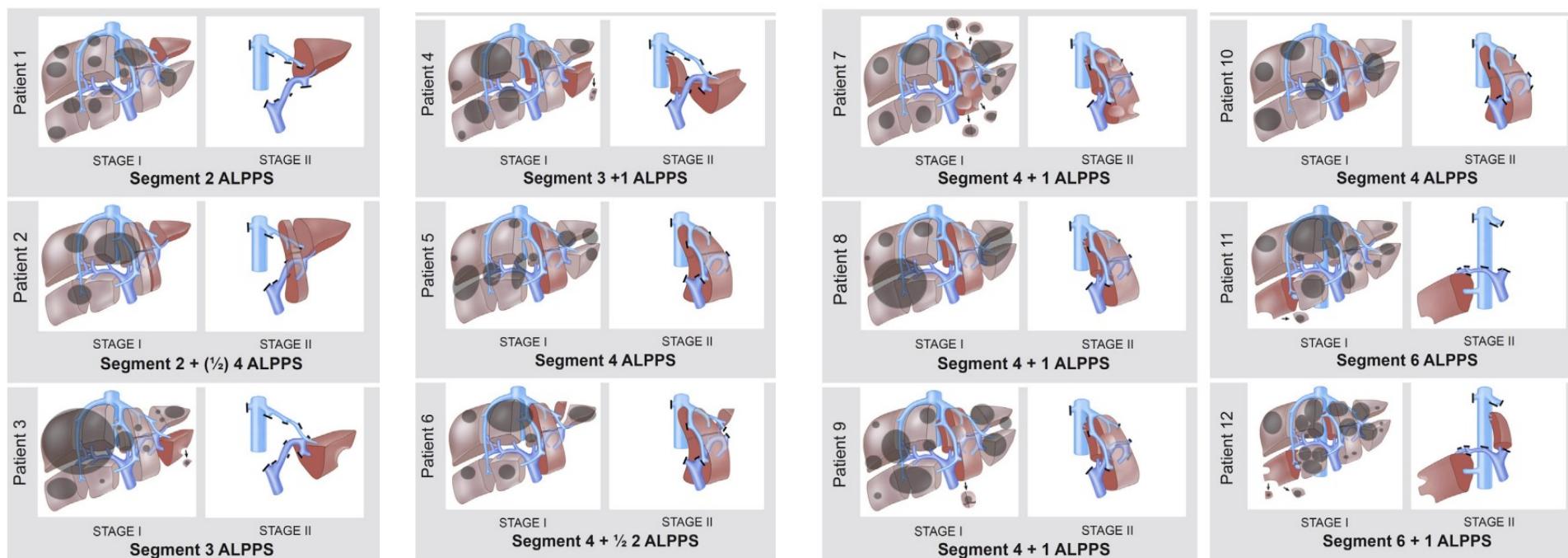
Enne M, et al. HPB 2017;19:1126-9

Lehwald-Tywuschik N, et al. BMC Surg 2020;20:63

Maulat C, et al. World J Clin Oncol 2017;8:351-9

Monosegment ALPPS hepatectomy: Extending resectability by rapid hypertrophy

Erik Schadde, MD, FACS,^a Massimo Malagó, MD,^b Roberto Hernandez-Alejandro, MD, FRCSC, FACS,^c Jun Li, MD,^d Eddie Abdalla, MD, FACS,^e Victoria Ardiles, MD,^f Georg Lurje, MD,^{b,g} Soumil Vyas, MS, FRCS,^b Marcel A. Machado, MD, FACS,^h and Eduardo de Santibañes, MD, PhD, FACS,^f Winterthur and Zurich, Switzerland, London, UK, London, Ontario, Canada, Hamburg and Aachen, Germany, Beirut, Lebanon, Buenos Aires, Argentina, and São Paulo, Brazil



CASE

ALPPS MONOSEGMENT FOR COLORECTAL LIVER METASTASIS

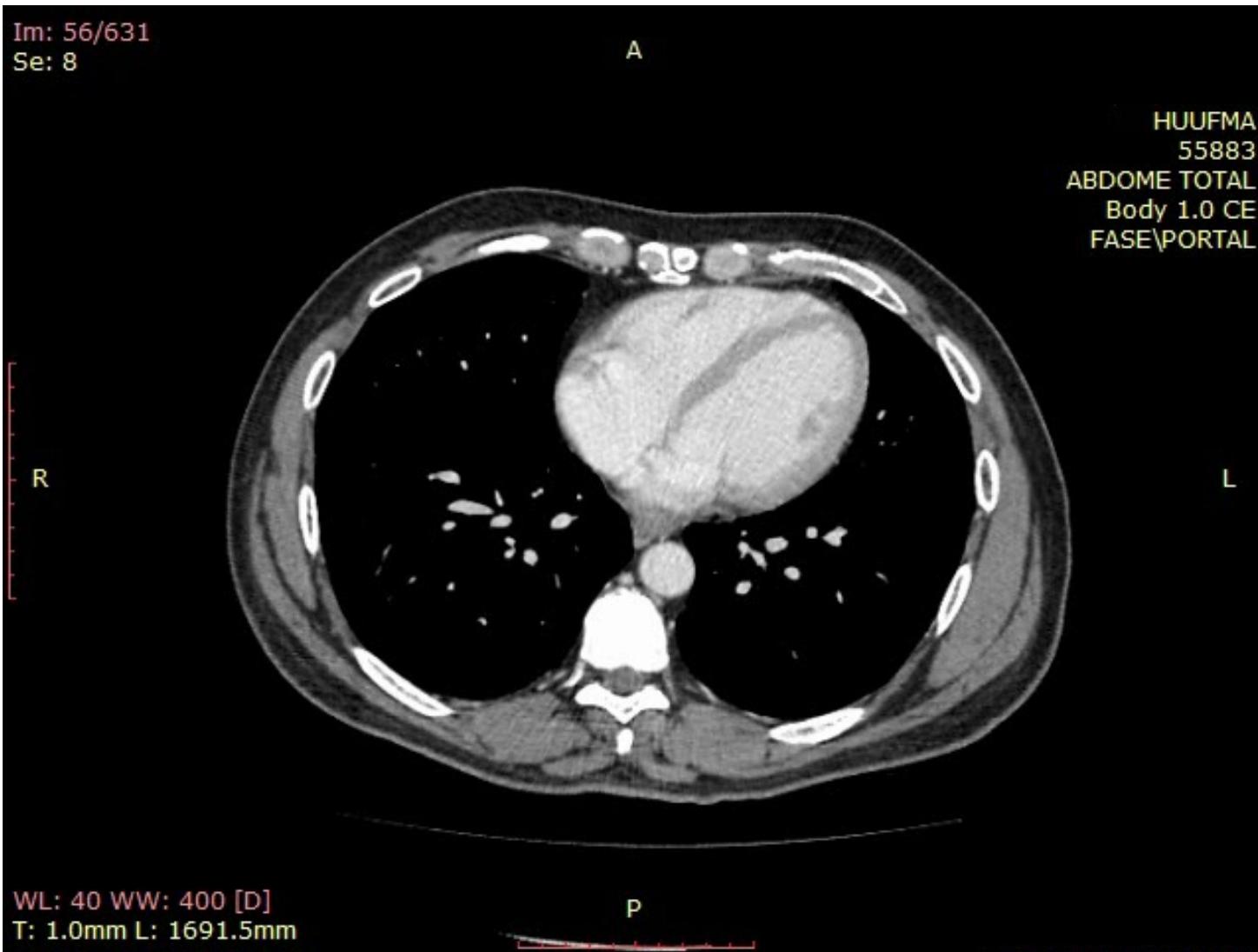
Monosegment ALPPS

- 54-year-old male patient
 - Synchronous liver metastases
 - Left sided colon tumor
- Primary resected previously
 - Colostomy
- Chemotherapy
 - FOLFOX 12 cicles

KRAS Wild-type

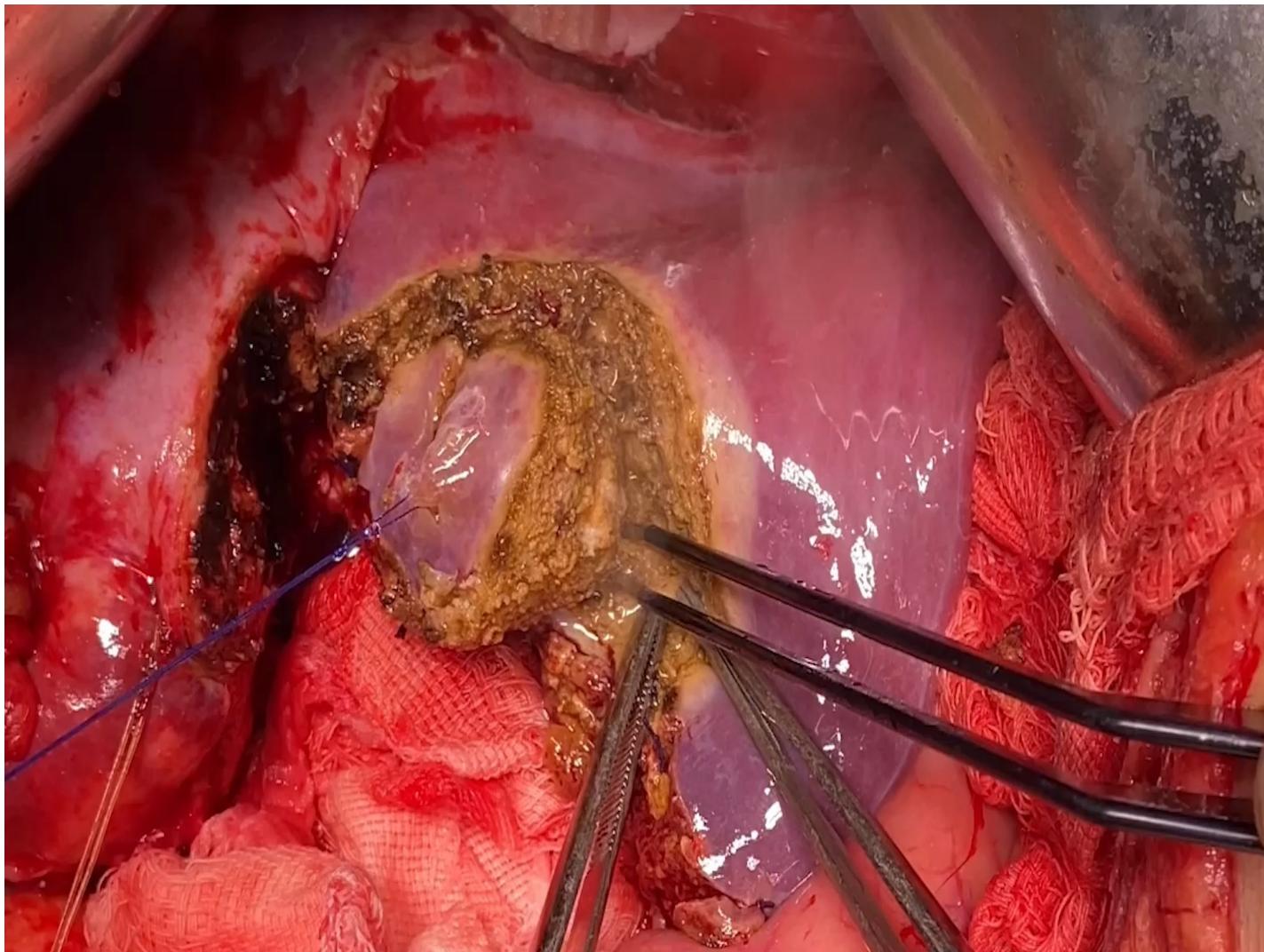
CT

Liver metastases:
 Segment II preserved



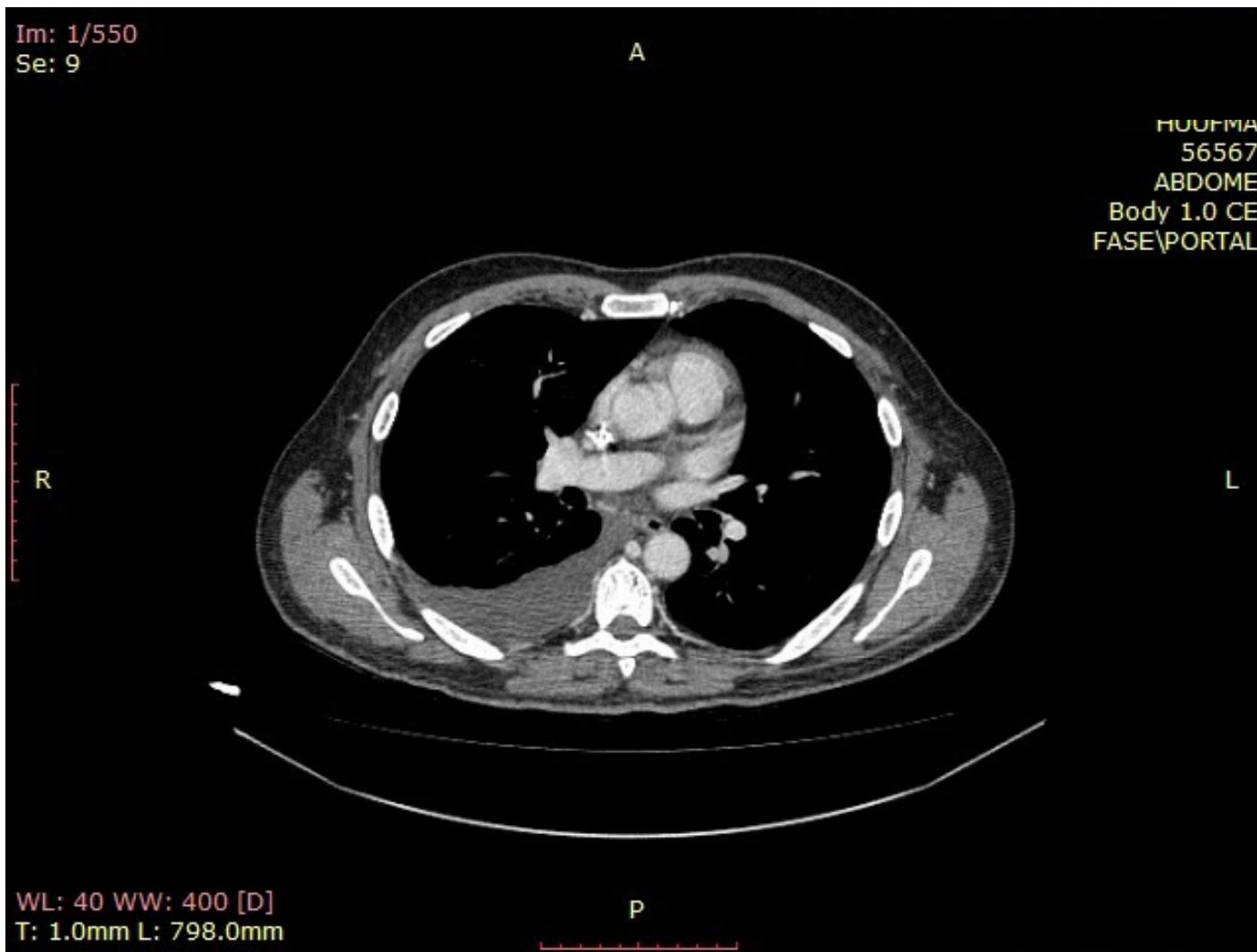
1st step

Decision (Tumor board)
ALPPS



CT scan

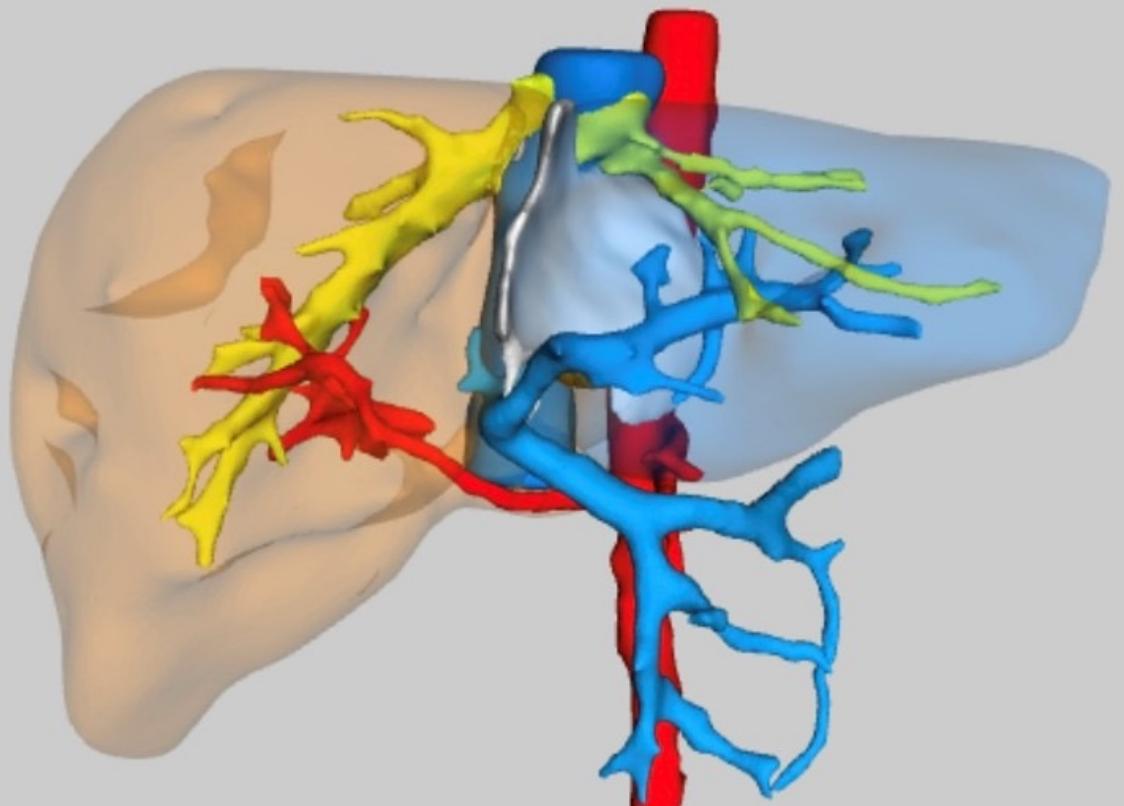
- After 3 weeks
- Portal phase



VOLUMETRY

Segment 2

FLR 32.7%



Name

Gender, Age

Liver View

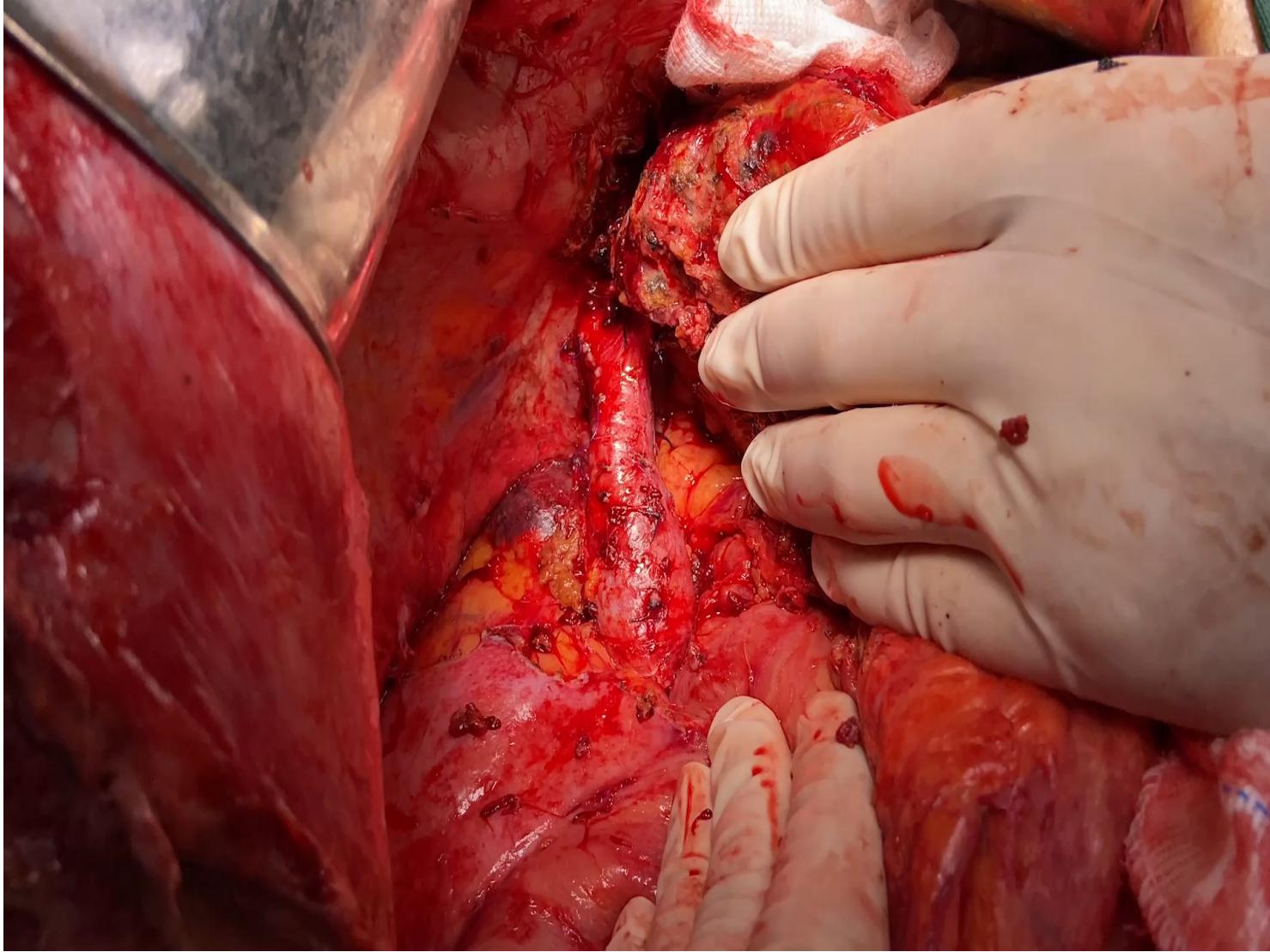


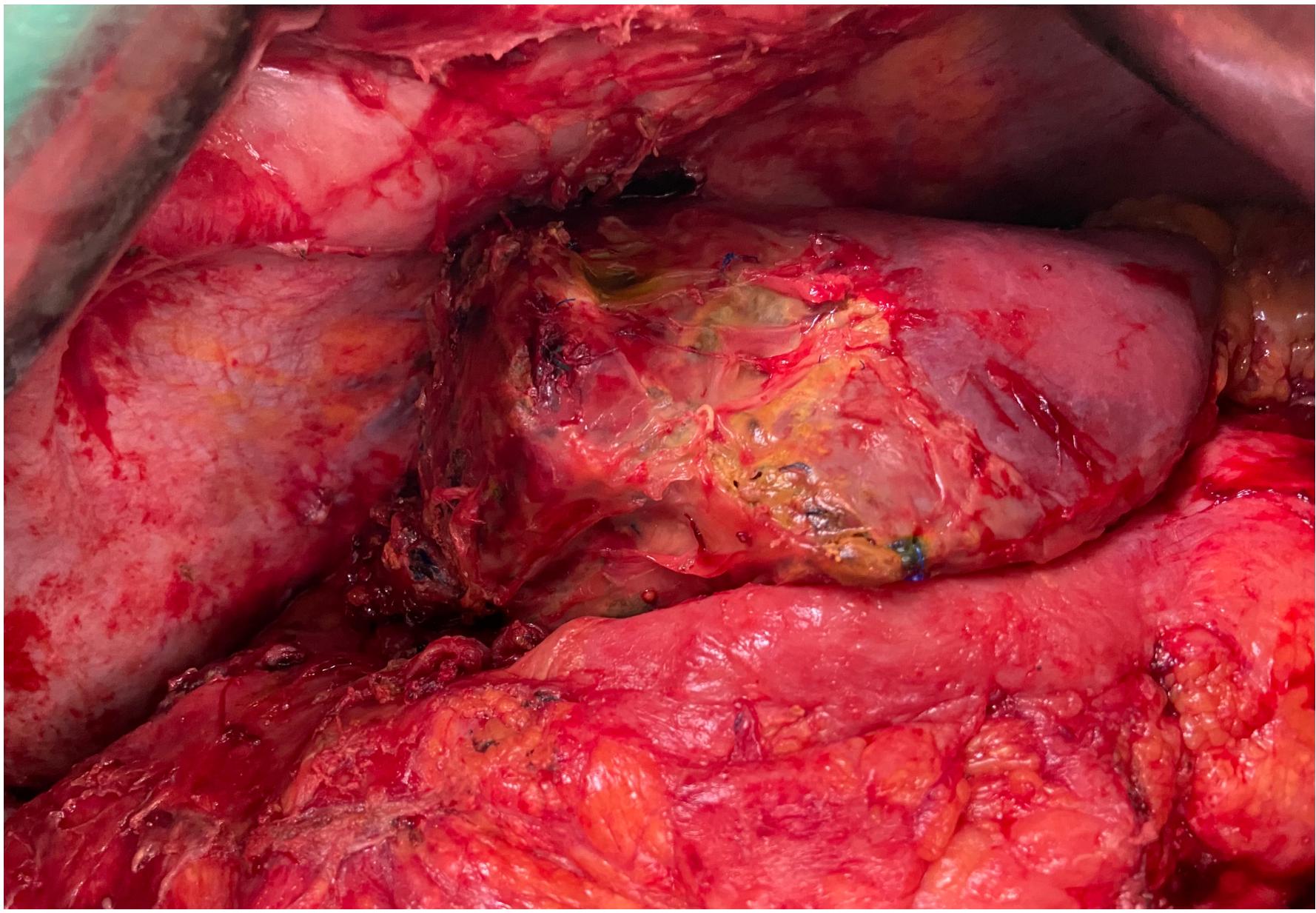
Serie/s View

Liver

Courtesy: Prof. Deniz Balci (Ankara - Turkey)

□ 2nd step







SPECIMEN



POSTOPERATIVE COURSE

- ICU 9 days
- Complications \geq 3b (clavien-dindo)
 - Reoperation (intestinal occlusion)
- Length of stay 34 days

CHEMOTHERAPY

AHPBA 2023

March 9 – 12, 2023
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Thanks !

Gracias !

Obrigado !