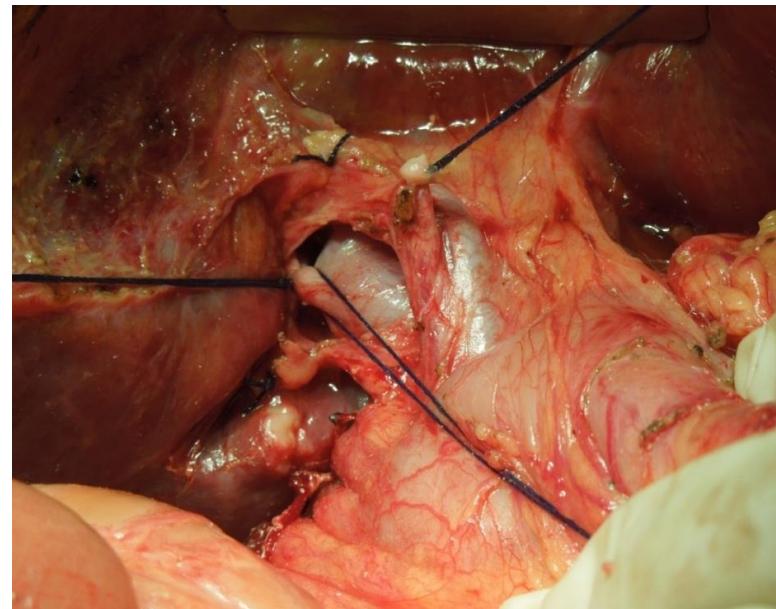
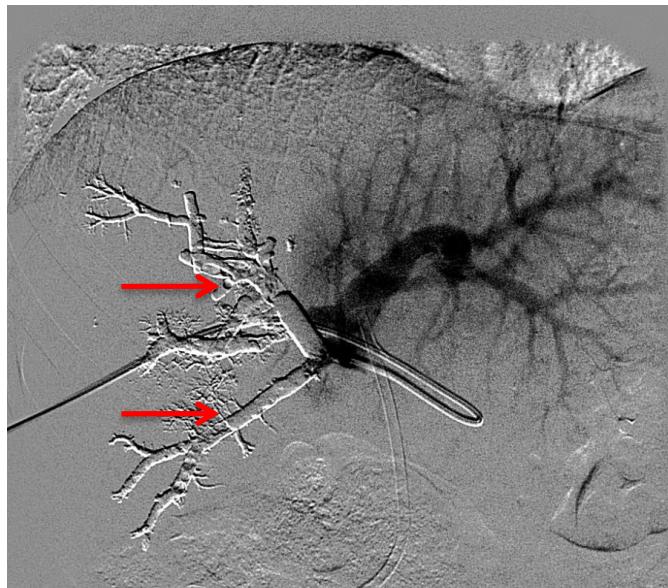


91° CONGRESO ARGENTINO DE CIRUGÍA

Buenos Aires, 9 al 12 de noviembre 2021

POSTOPERATIVE LIVER FAILURE



Orlando Jorge M. Torres MD, PhD
Full Professor and Chairman
Department of Gastrointestinal Surgery
Hepatopancreatobiliary Unit
Universidade Federal do Maranhão - Brazil

Choices of Therapeutic Strategies for Colorectal Liver Metastases Among Expert Liver Surgeons

A Throw of the Dice?

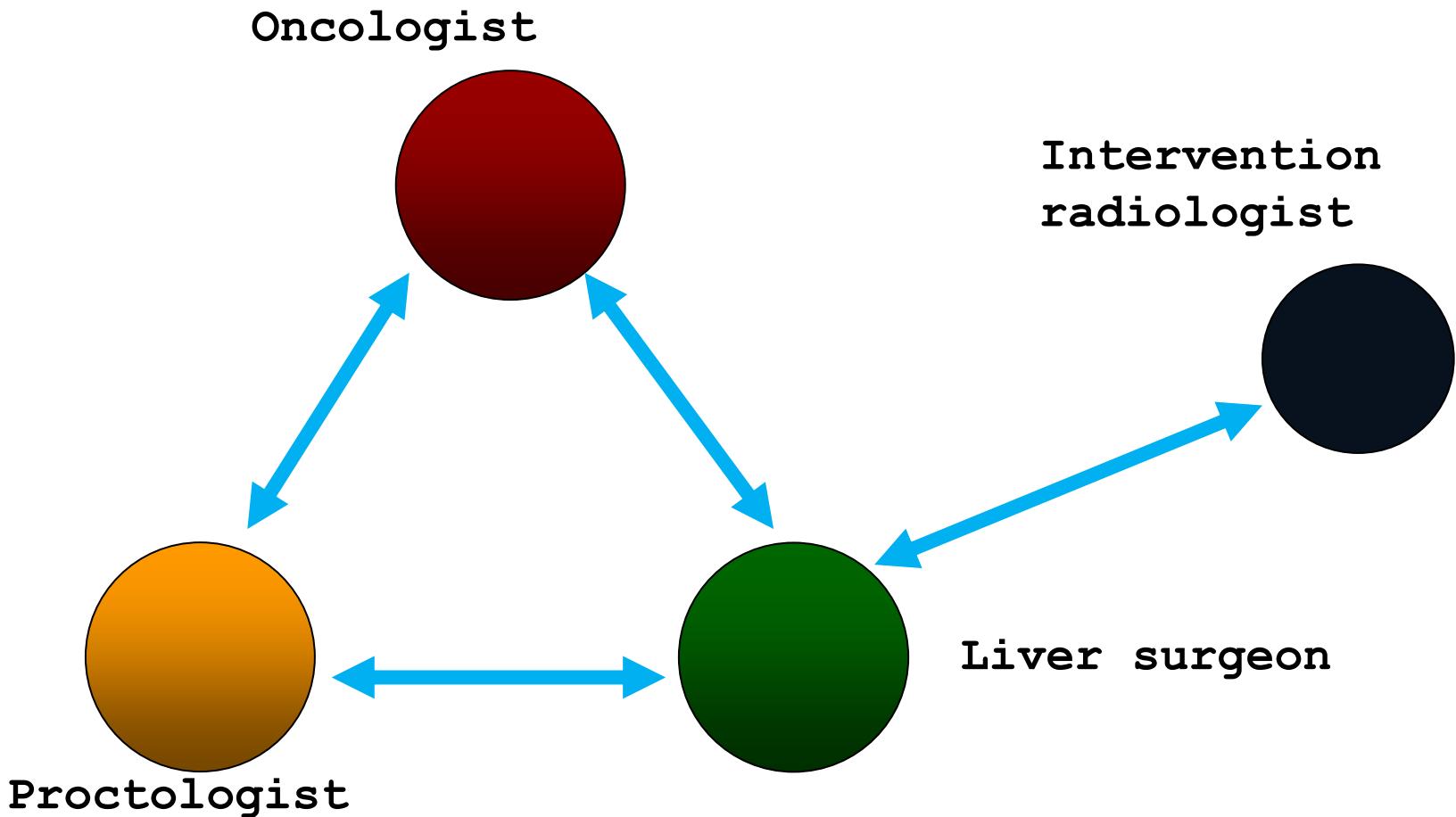
Povilas Ignatavicius, MD,* Christian E. Oberkofler, MD,* William C. Chapman, MD,†
 Ronald P. DeMatteo, MD,‡ Bryan M. Clary, MD,§ Michael I. D'Angelica, MD,¶ Kenneth K. Tanabe, MD,||
 Johnny C. Hong, MD,** Thomas A. Aloia, MD,†† Timothy M. Pawlik, MD, MPH, PhD,‡‡
 Roberto Hernandez-Alejandro, MD,§§ Shimul A. Shah, MD,¶¶ Jean-Nicolas Vauthey, MD,††
 Guido Torzilli, MD,|||| Hauke Lang, MD,*** Pål-Dag Line, MD, PhD,††† Olivier Soubrane, MD,†††
 Hugo Pinto-Marques, MD,**** Ricardo Robles-Campos, MD,¶¶¶ Karim Boudjema, MD,|||||||
 Peter Lodge, MD,**** René Adam, MD,†††† Christian Toso, MD,†††† Alejandro Serrablo, MD, PhD,\$\$\$\$\$
 Luca Aldrighetti, MD,¶¶¶¶ Michelle L. DeOliveira, MD,* Philipp Dutkowski, MD,* Henrik Petrowsky, MD,*
 Michael Linecker, MD,* Cácia S. Reiner, MD,|||||| Julia Braun, PhD,***** Ruslan Alikhanov, MD,†††††
 Giedrius Barauskas, MD,††††† Albert C. Y. Chan, MS,\$\$\$\$\$ Jiahong Dong, MD,¶¶¶¶¶
 Norihiro Kokudo, MD,||||||| Masakazu Yamamoto, MD,***** Koo Jeong Kang, MD,††††††
 Yuman Fong, MD,††††† Mohamed Rela, MD,\$\$\$\$\$ Xabier De Artxabala, MD,¶¶¶¶¶¶
 Eduardo De Santibañes, MD, PhD,||||||| Miguel Ángel Mercado, MD,***** Oscar C. Andriani, MD,†††††††
Orlando Jorge M. Torres, MD, ††††† Antonio D. Pinna, MD,\$\$\$\$\$ and Pierre-Alain Clavien, MD, PhD*✉

TABLE 1. Agreement (Percentage) Among Experts for Each Clinical Case

	1*	2*	3*	4*	5	6	7	8	9	10	All (IRQ)
<u>Resectability (Yes/No)</u>	100	100	100	100	95	95	97	84	89	63	96 (88–100)
Initial treatment (surgery, chemotherapy)	53	84	97	97	82	86	58	83	86	68	84 (66–89)
Approach (open, minimally invasive)	71	63	58	46	92	89	95	94	100	96	91 (62–95)
Portal vein embolization (Yes/No)	92	100	79	100	89	68	95	75	57	52	84 (65–96)
Preoperative volumetry (Yes/No)	71	97	66	95	79	57	84	56	81	67	75 (64–87)
Type of surgery (2-stage, 1-stage)	100	100	95	100	89	62	92	62	44	44	91 (58–100)
Type of resection (anatomical, parenchyma sparing)	47	82	47	61	81	49	51	56	79	60	58 (49–80)
Ablation in combination with resection (Yes/No)	97	97	76	92	50	62	55	51	65	56	64 (54–93)

*Low complexity cases.

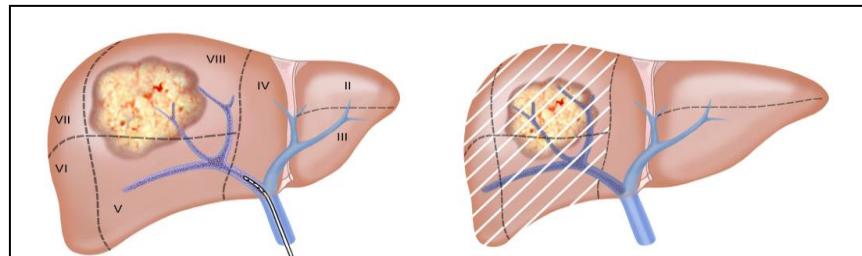
Multidisciplinary team



LIVER METASTASIS: STRATEGIES

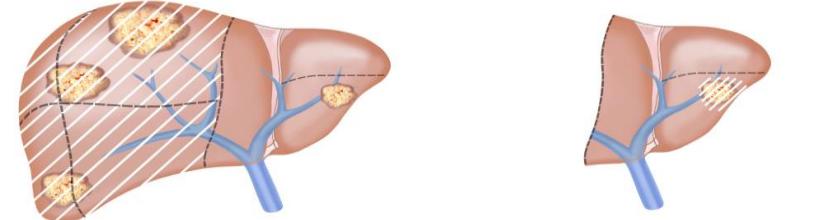
PORTAL VEIN EMBOLIZATION (PVE)

Makuuchi M, et al. Surgery 1990



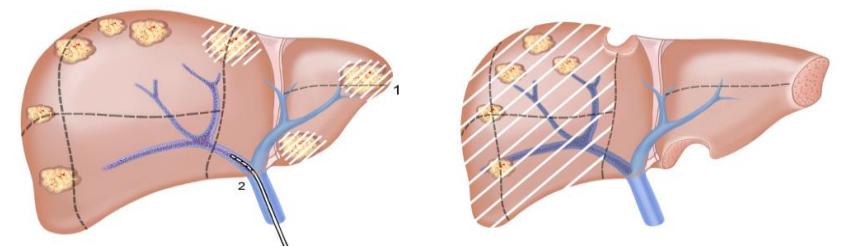
TWO-STAGE HEPATECTOMY

Adam R, et al. Ann Surg 2000



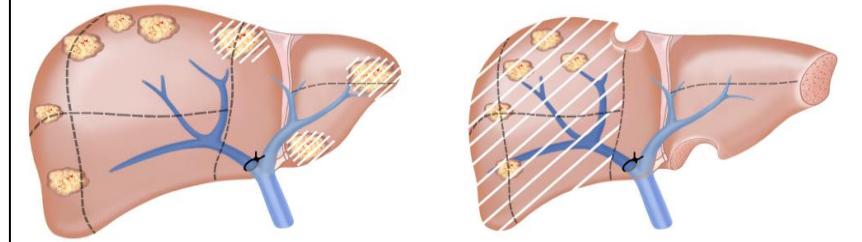
TWO-STAGE HEPATECTOMY + PVE

Jaeck D, et al. Ann Surg 2004



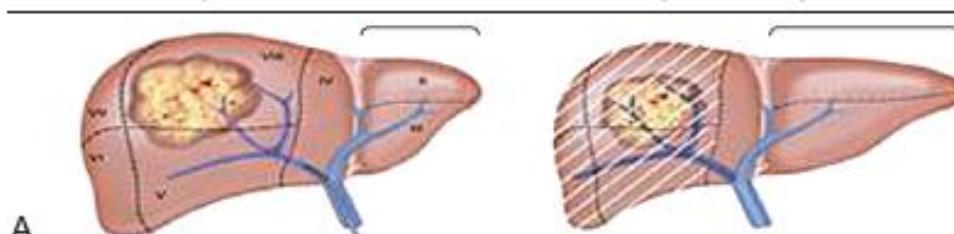
TWO-STAGE HEPATECTOMY + PVL

Belghiti J, et al. Hepatology 2008



Percutaneous portal vein embolization

Hepatectomy



A
1st Hepatectomy 2nd Hepatectomy

Percutaneous embolization

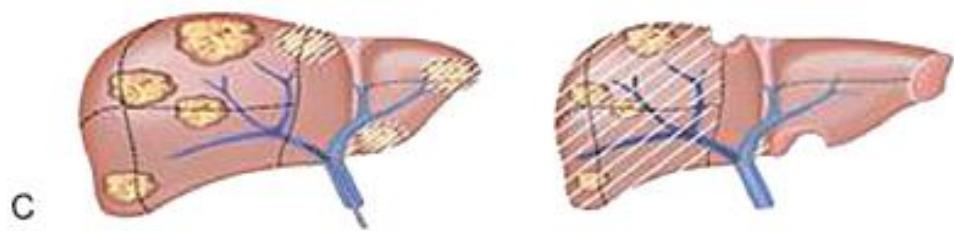
40-50% hypertrophy
Period: 6-12 weeks



B

2-staged hepatectomy

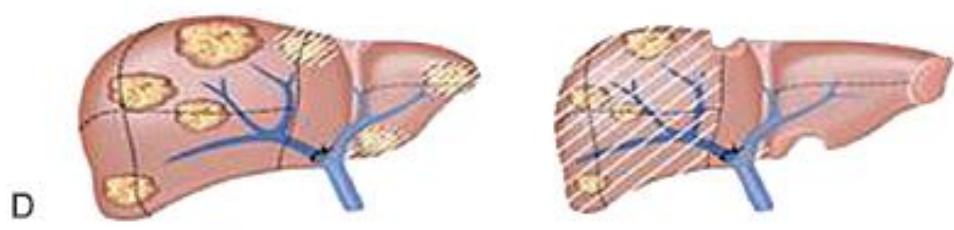
30-40% hypertrophy
Period: 6-10 weeks



C

2-staged hepatectomy + portal vein embolization

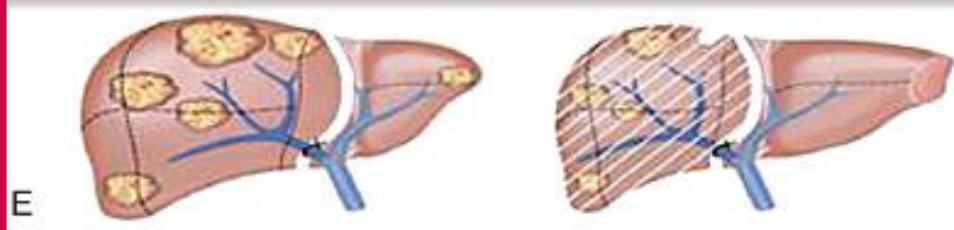
40-60% hypertrophy
Period: 12-16 weeks



D

2-staged hepatectomy + portal vein ligation

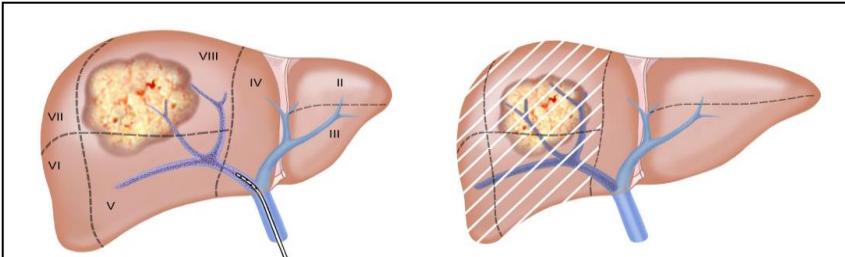
40-50% hypertrophy
Period: 4-6 weeks



E

ALPPS

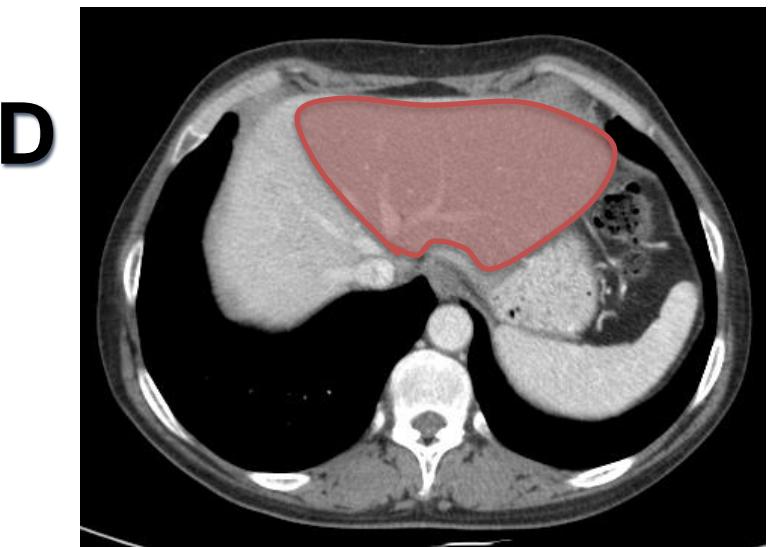
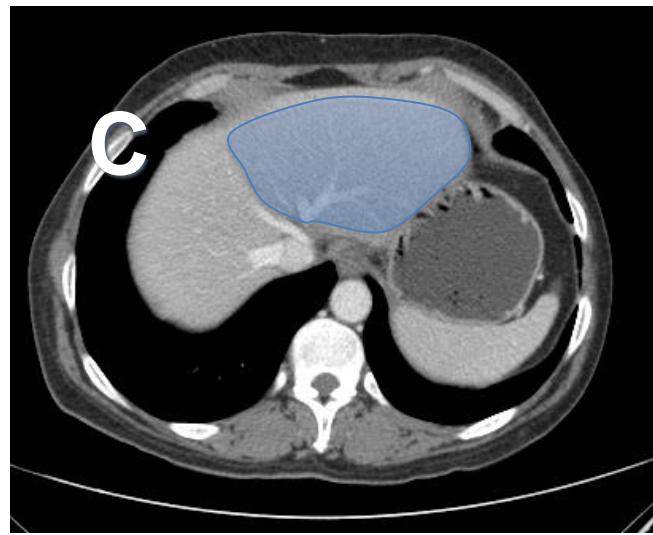
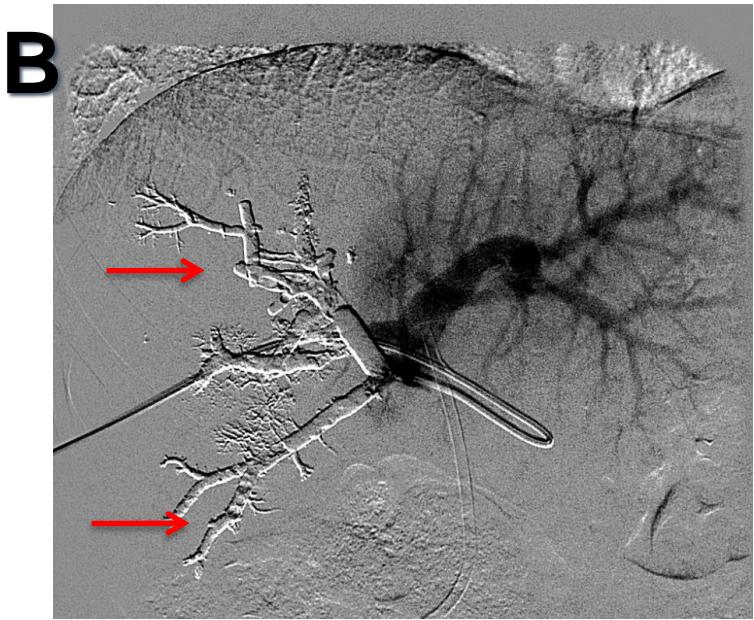
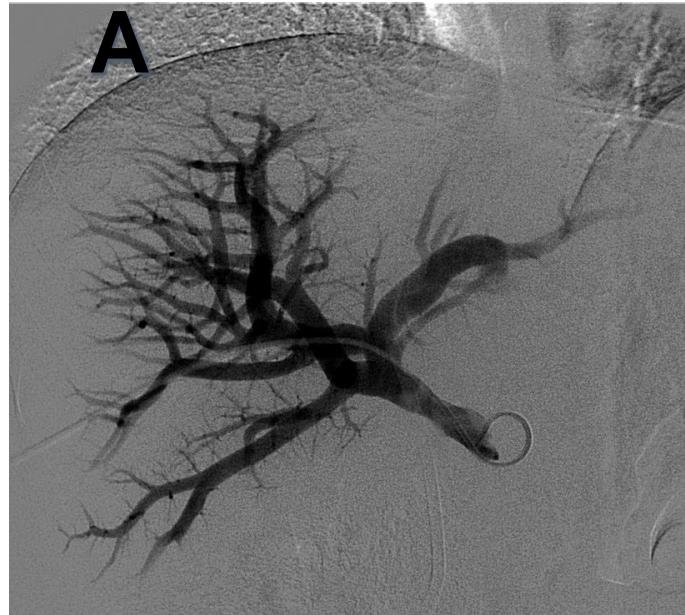
80-120% hypertrophy
Period: 1-2 weeks



Portal vein embolization



- Right portography
- Access of segment 4
- Portal vein embolization
- Flow to the left lobe preserved



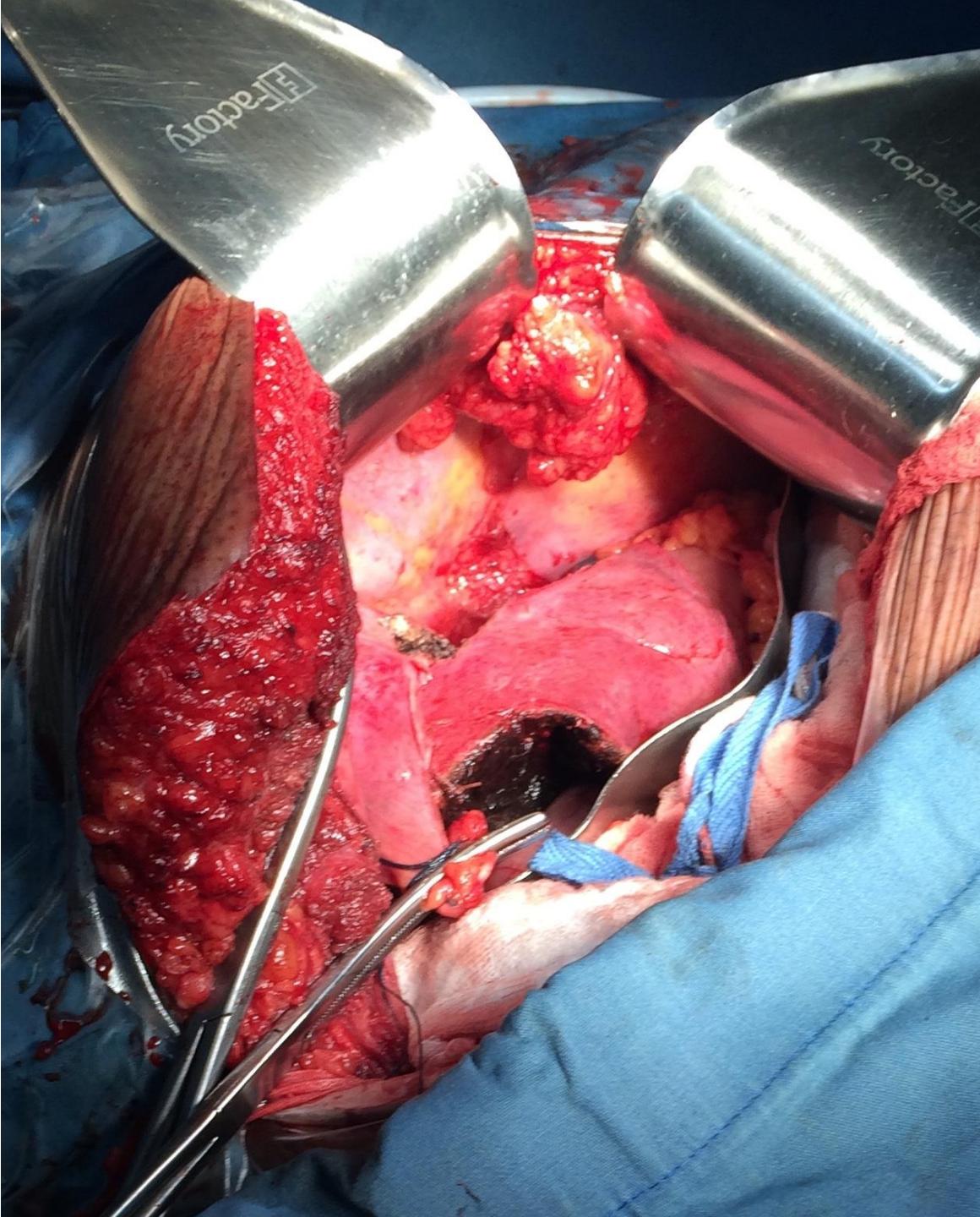
Optimal patient selection for successful two-stage hepatectomy of bilateral colorectal liver metastases

Katsunori Imai^{1,2}  | Marc-Antoine Allard¹ | Hideo Baba²  | René Adam¹

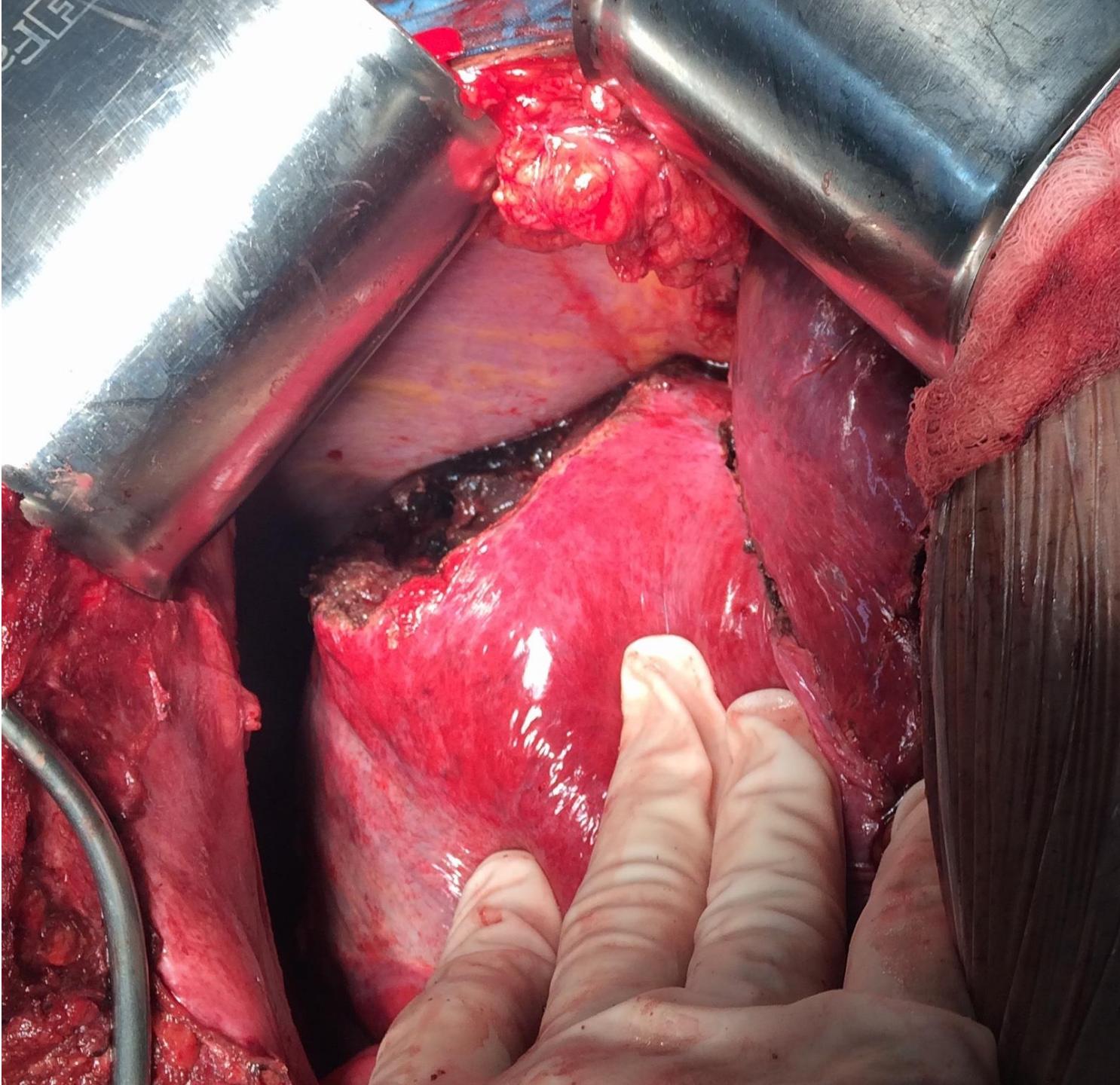
TABLE 3 Independent prognostic factors for survival after TSH

Study	Year	Country	No. of pts.	5-y OS	Independent prognostic factors (multivariate)	Patient cohort
Wichert et al	2008	France	41	42	Tumor number ≥6 Concomitant extrahepatic disease No postoperative chemotherapy	TSH completed cohort
Brouquet et al	2011	USA	62	51	Major complication after first- or second-stage TSH failure	whole cohort
Giuliante et al	2014	Italy	102	32	Chemotherapy cycle ≥6	TSH completed cohort
Faitot et al	2015	France	50	27 (3-y)	TSH failure	whole cohort
Passot et al	2016	USA	109	49 (completed)	Rectal primary Tumor number ≥6 Interval chemo after first-stage RAS mutation	whole cohort
Imai et al	2019	France	93	41.3	Major complication at second-stage No repeat surgery for recurrence	TSH completed cohort
Lillemoe et al	2019	USA	83	47	No repeat surgery for recurrence First recurrence at multiple sites RAS mutation	TSH completed cohort (patients with recurrence)

Abbreviations: OS, overall survival; TSH, two-stage hepatectomy.

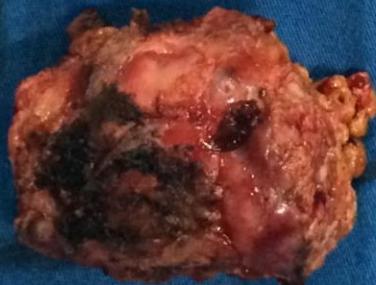
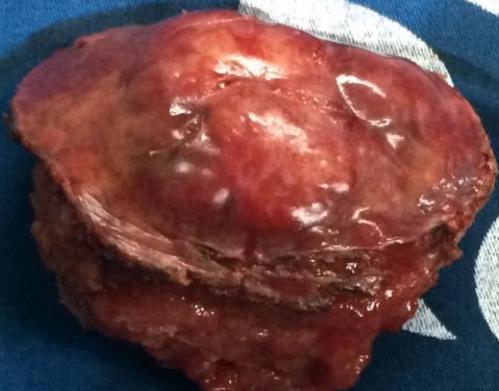


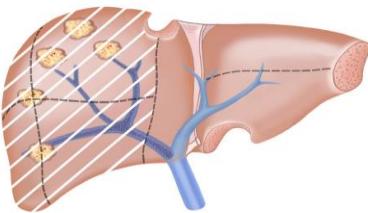
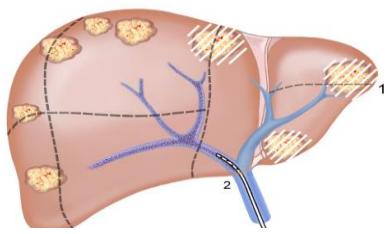






hospitais
São Domingos





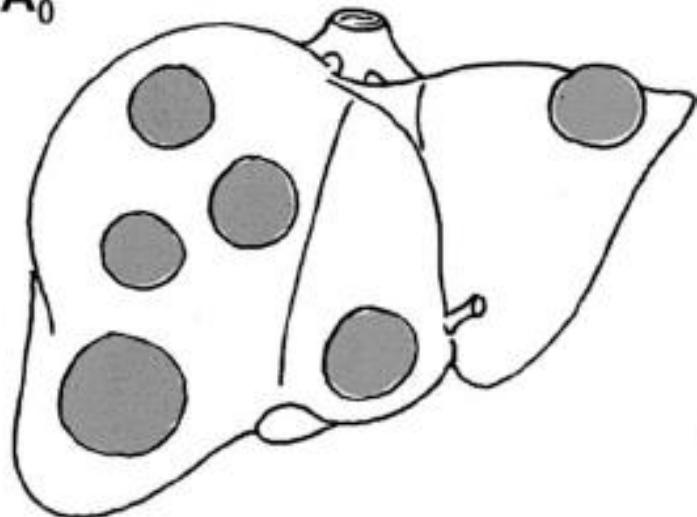
Two-stage hepatectomy + PVE

ORIGINAL ARTICLES

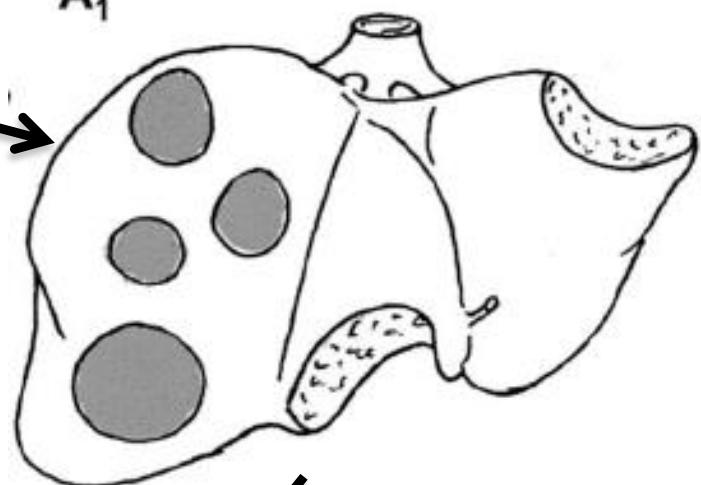
A Two-Stage Hepatectomy Procedure Combined With Portal Vein Embolization to Achieve Curative Resection for Initially Unresectable Multiple and Bilobar Colorectal Liver Metastases

Daniel Jaeck, MD, PhD, FRCS, Elie Oussoultzoglou, MD,* Edoardo Rosso, MD,* Michel Greget, MD,† Jean-Christophe Weber, MD, PhD,* and Philippe Bachellier, MD**

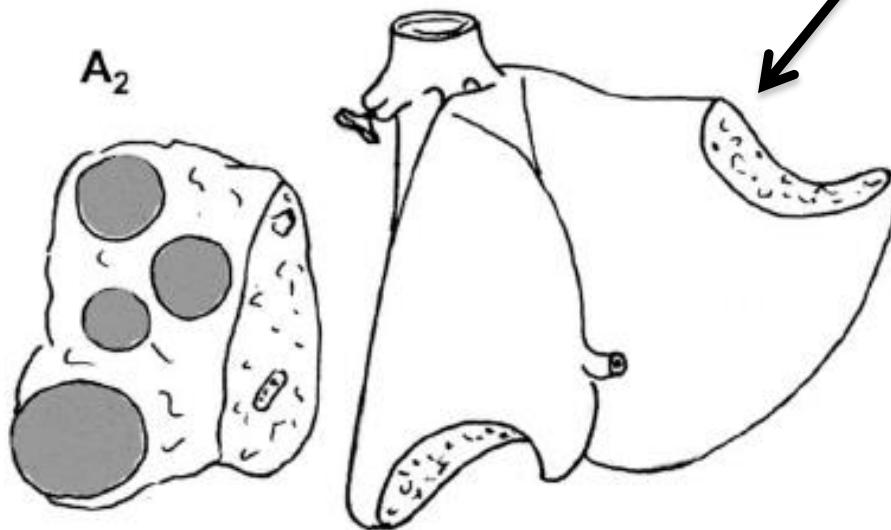
A₀



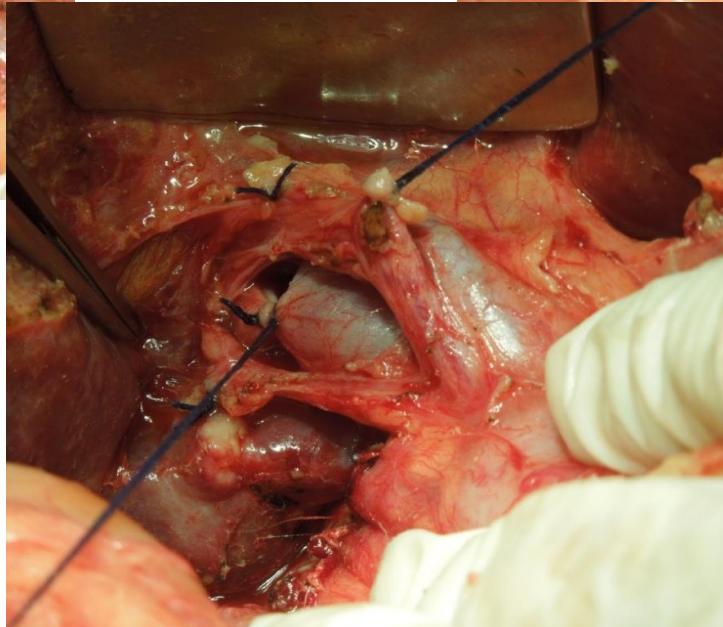
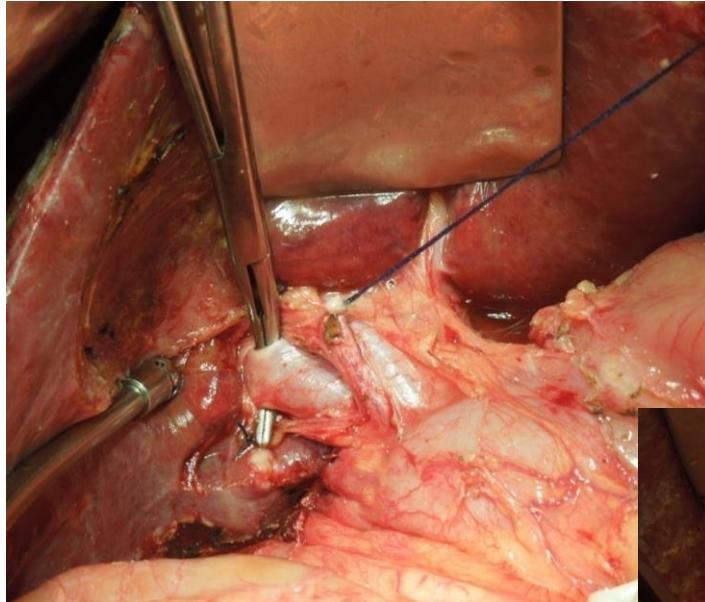
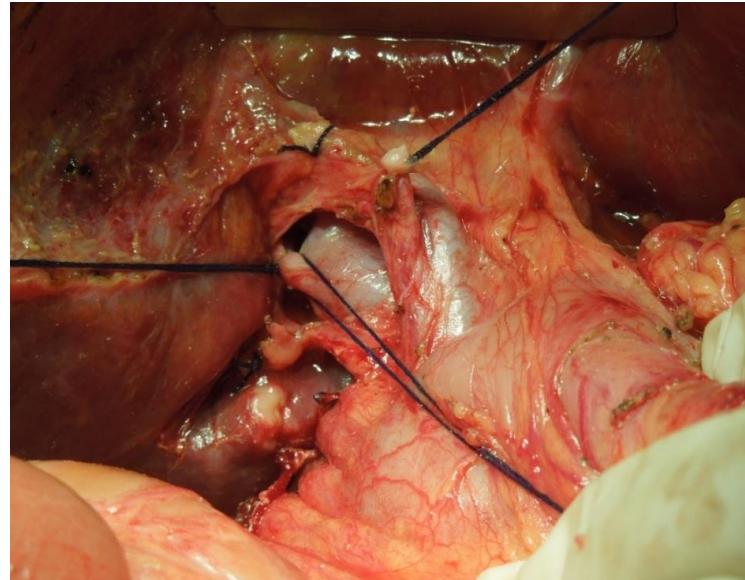
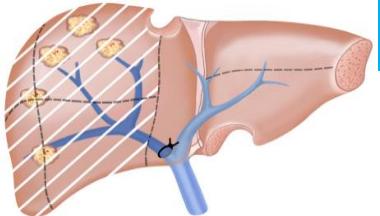
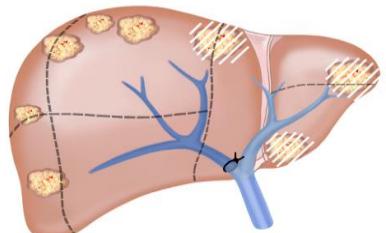
A₁



A₂

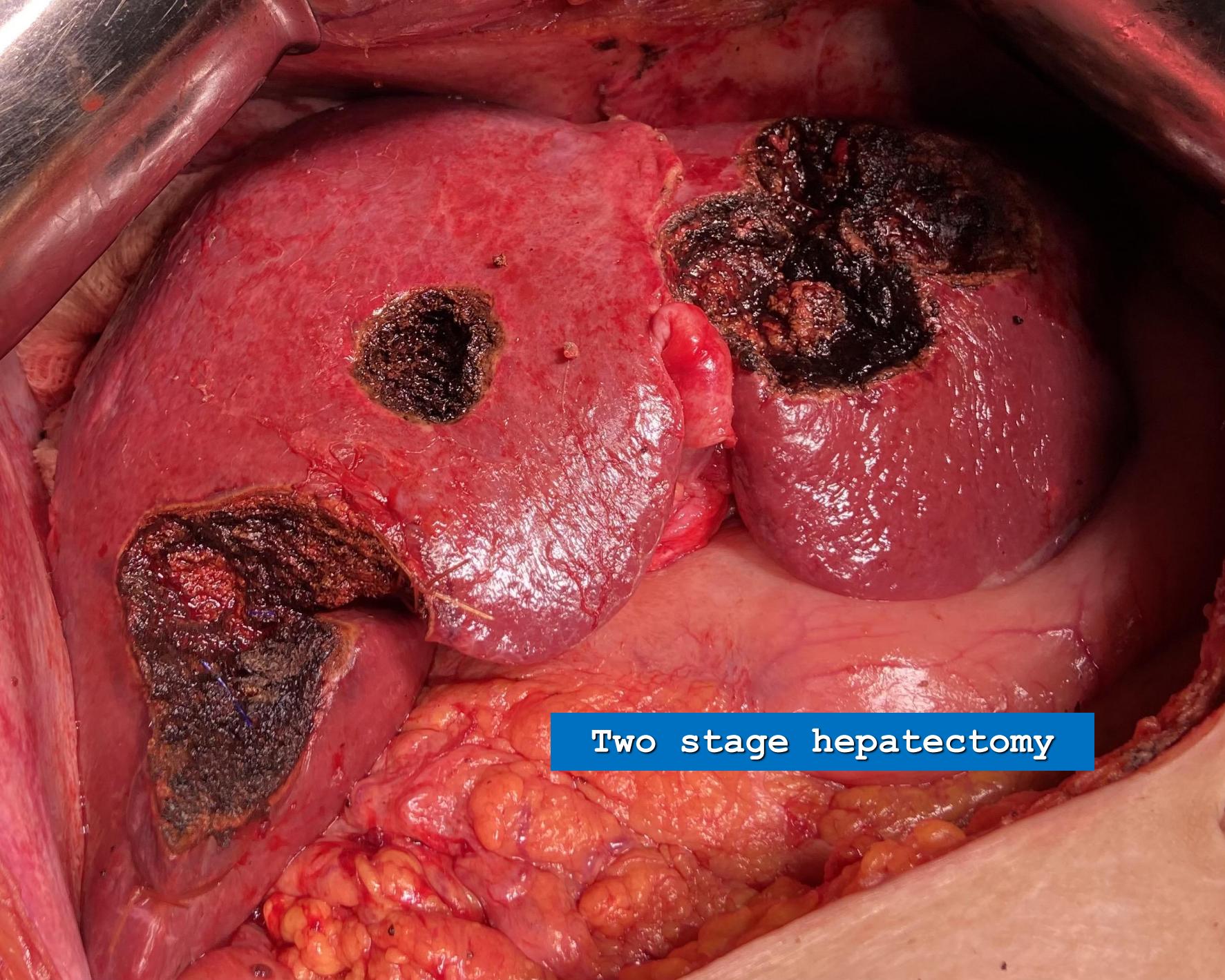


Two-stage hepatectomy + PVL



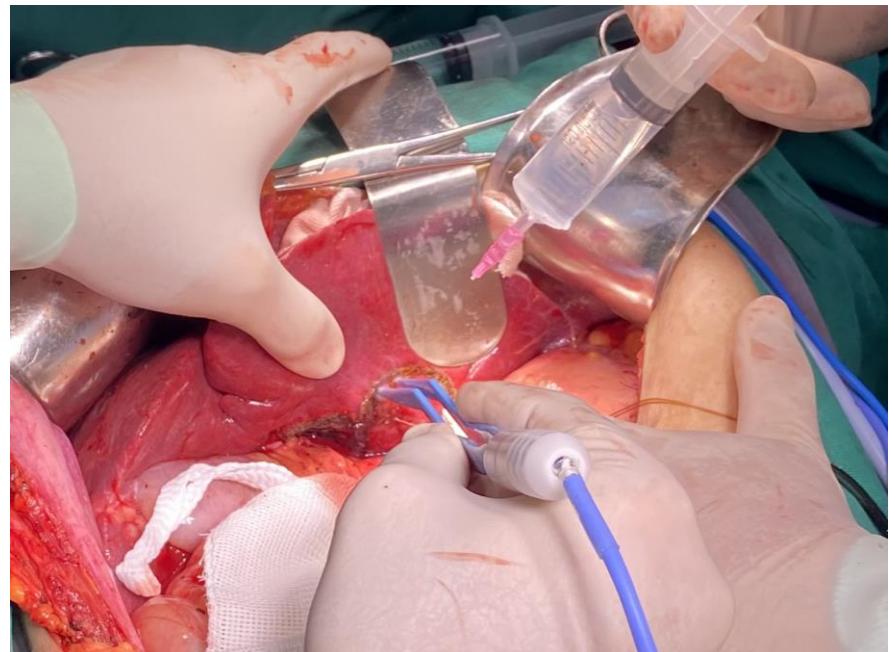
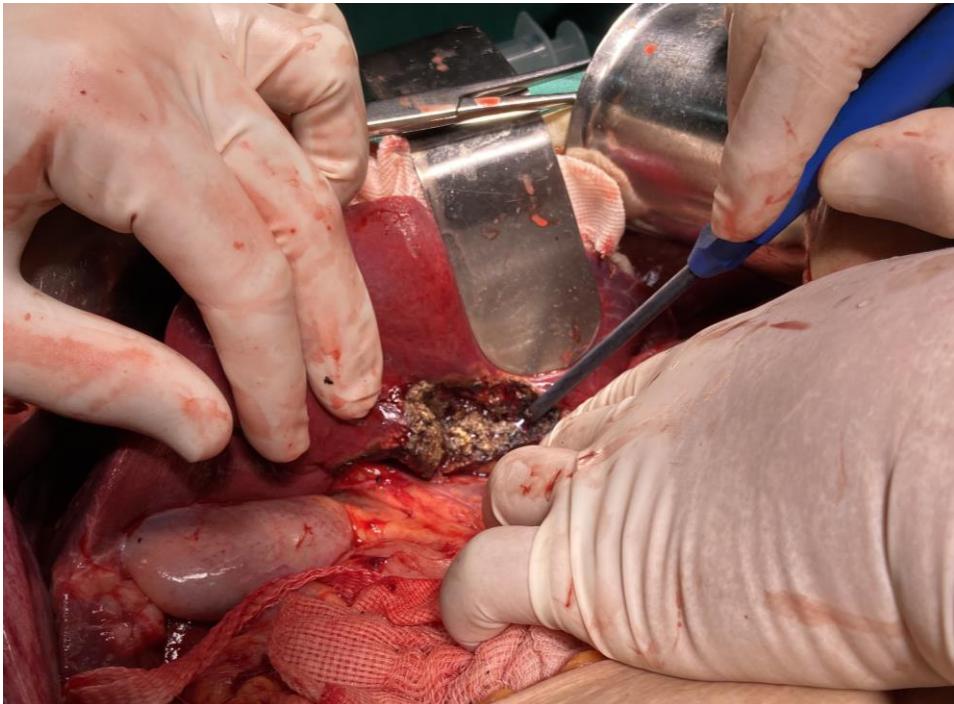
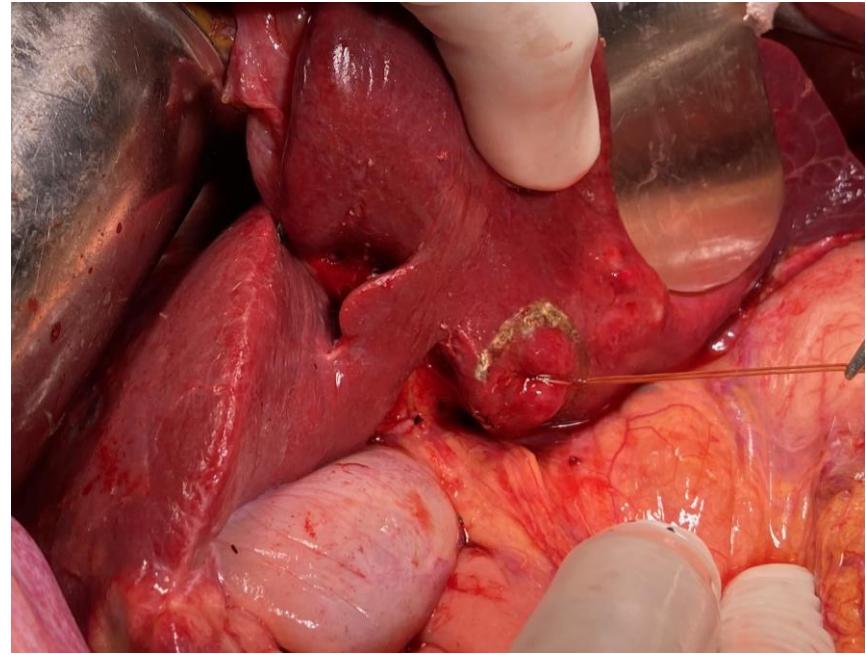
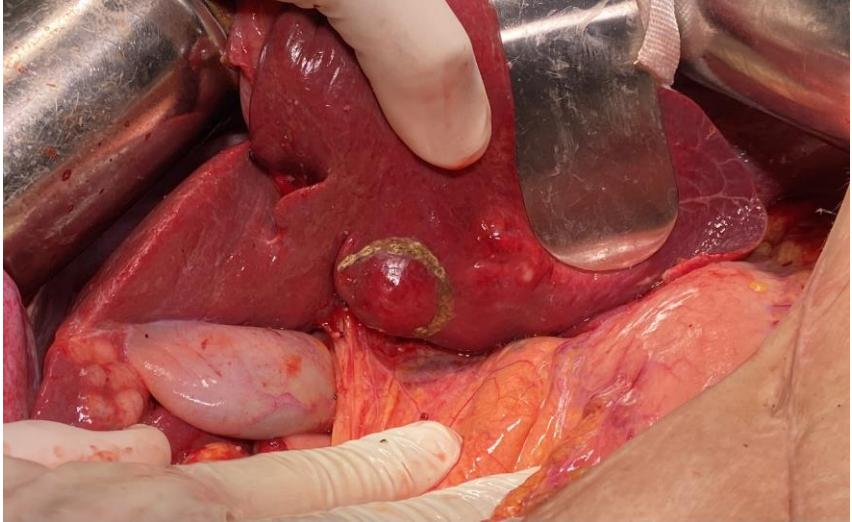
CASE 1

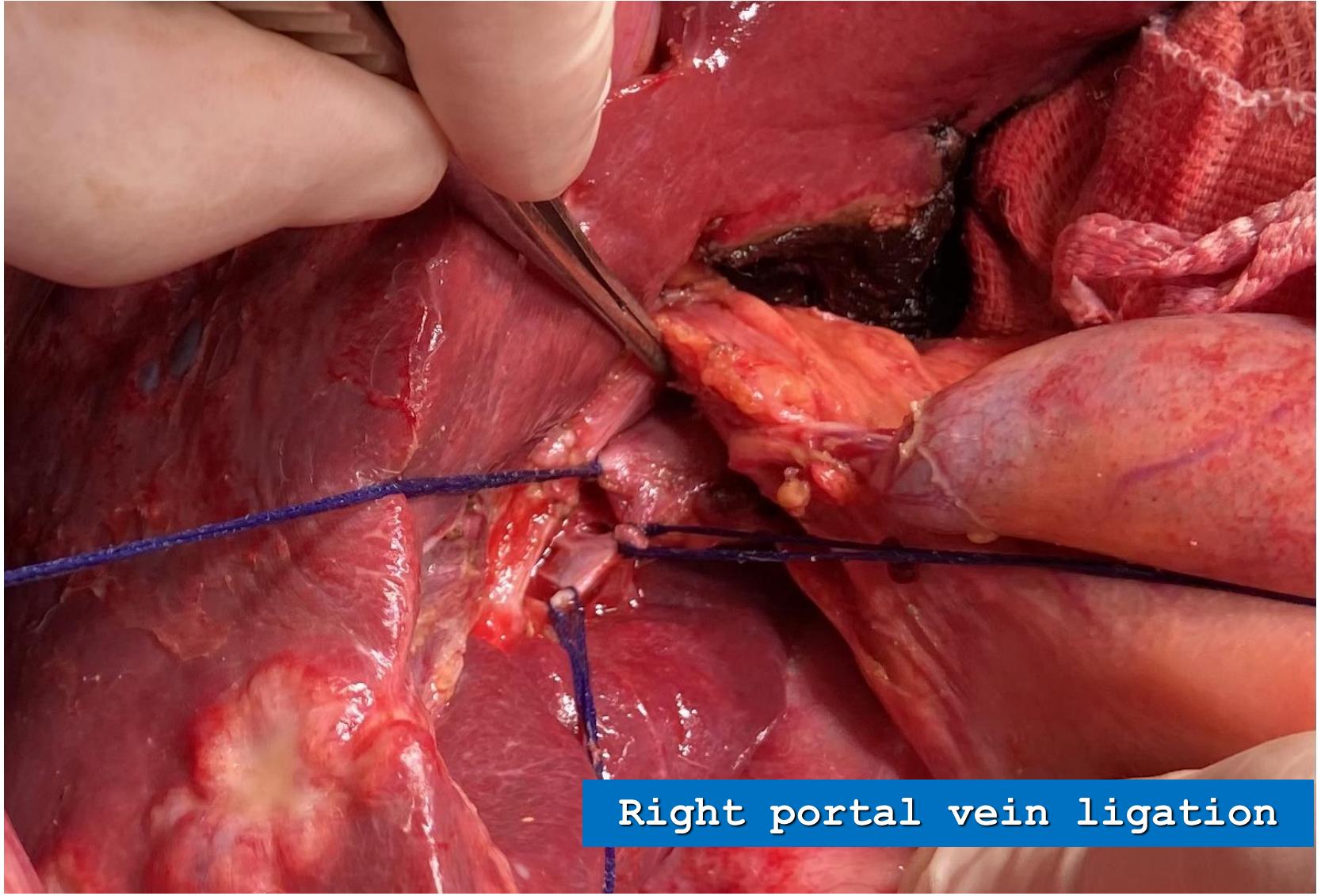
- 67-year-old female patient
 - Synchronous liver metastases
 - Left sided colon tumor
- The primary was previously resected:
 - Left colectomy
 - Lymphadenectomy
- Chemotherapy

An intraoperative photograph showing a large portion of a liver with several dark, necrotic, and charred areas, indicating extensive tissue damage or coagulation. The liver is red and textured, with some areas appearing darker due to the surgical process. A blue rectangular box contains the text "Two stage hepatectomy".

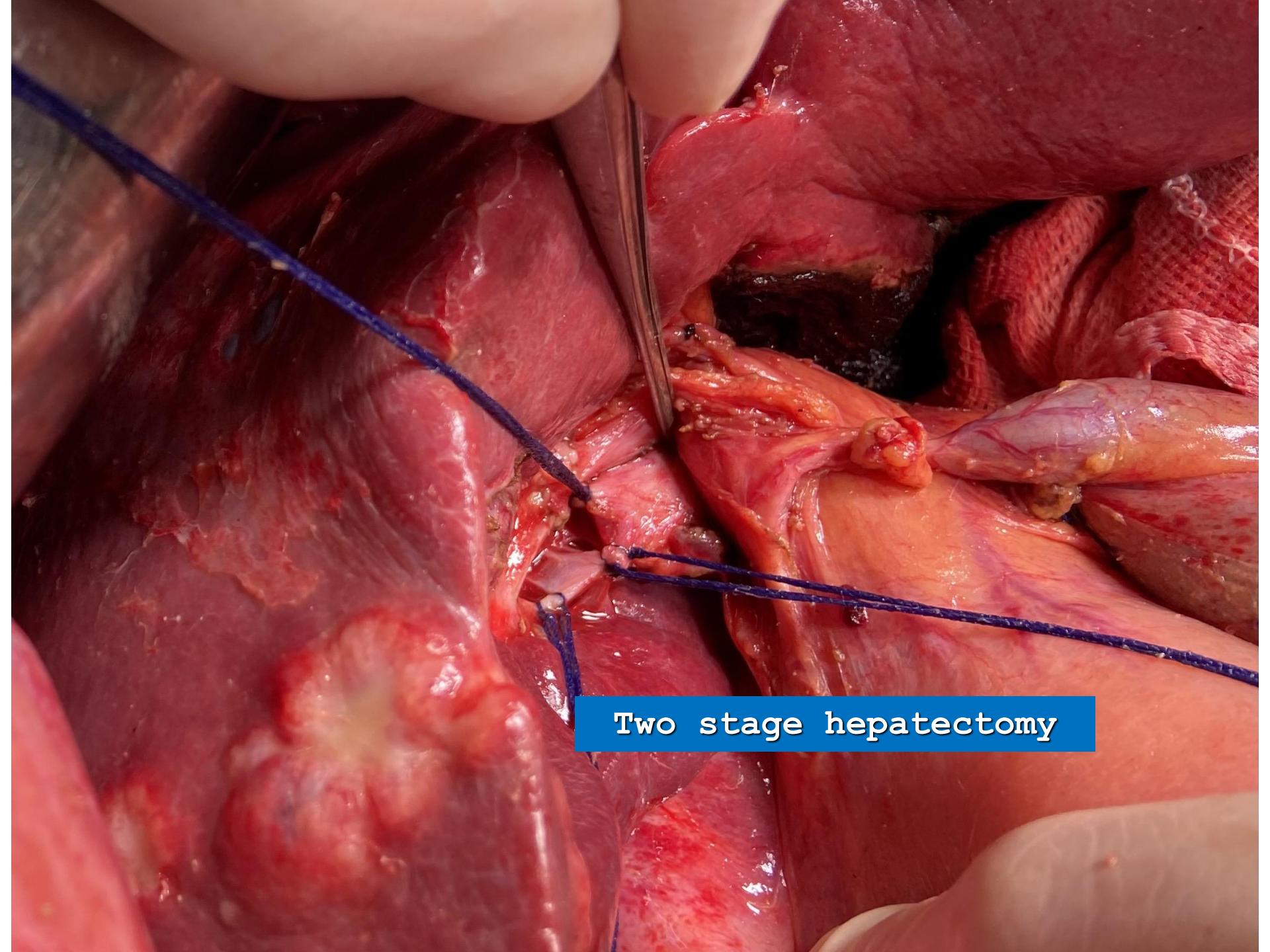
Two stage hepatectomy

Two stage hepatectomy

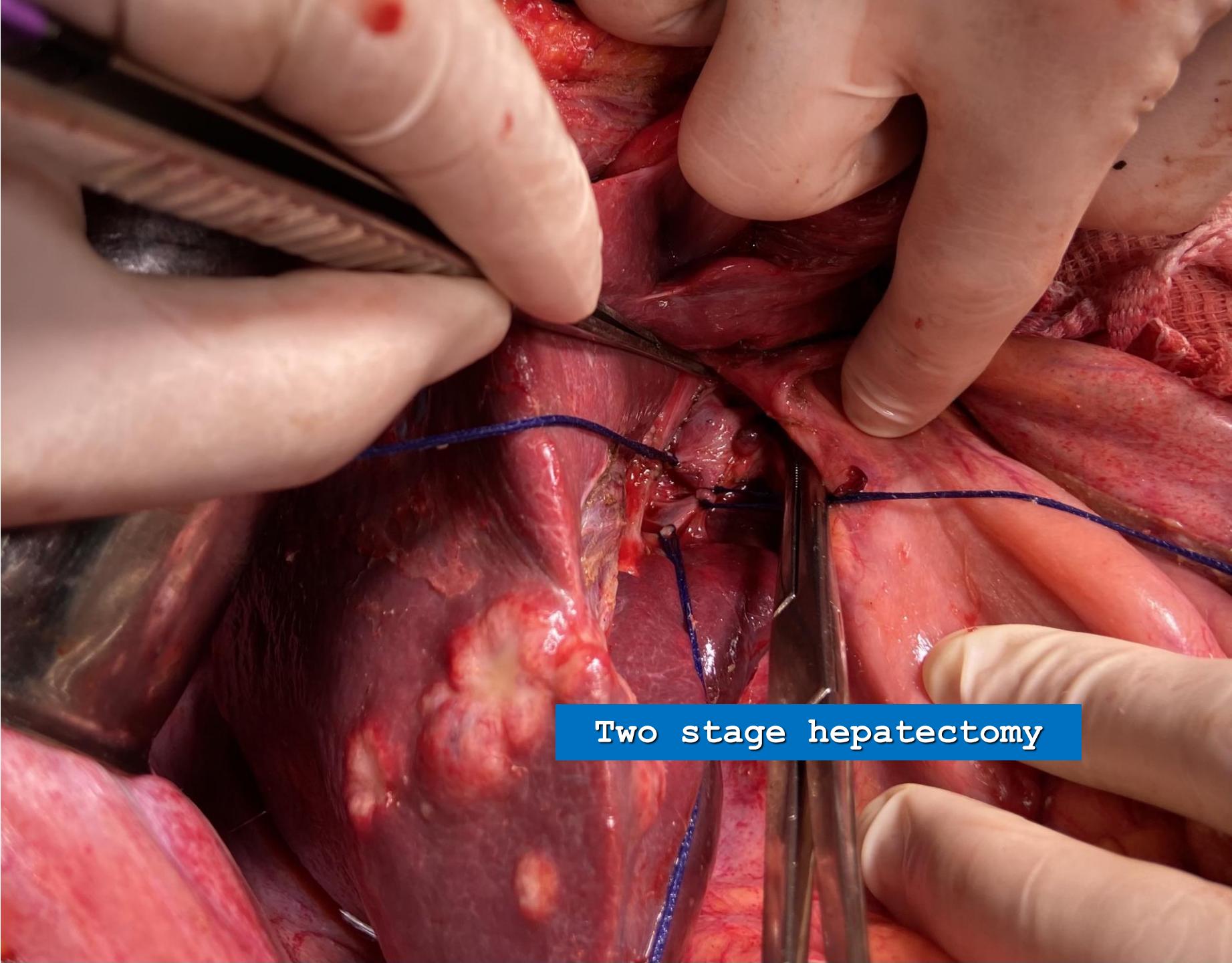




Right portal vein ligation

An intraoperative photograph showing a large portion of a liver being resected. The liver is a reddish-pink organ with visible blood vessels and tissue planes. Several blue surgical clips are applied to the liver tissue, particularly along the lower edge where a large incision has been made. A scalpel blade is held vertically near the center of the resection site. The surrounding tissue appears dark and somewhat charred or discolored from the surgery.

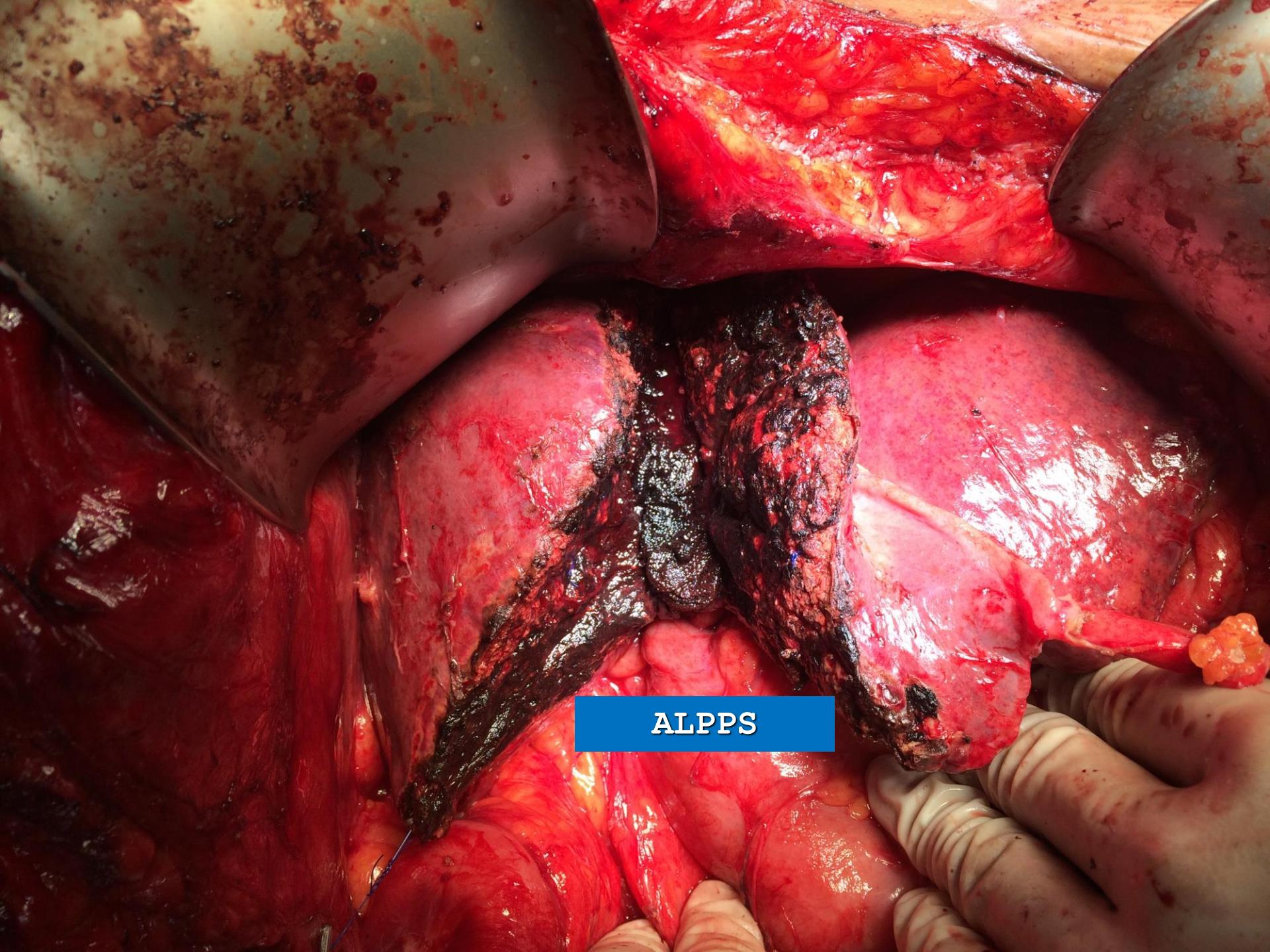
Two stage hepatectomy



A close-up photograph of a surgical procedure. A surgeon's hands, wearing light blue gloves, are visible. One hand holds a long, thin, curved retractor or牵钩 (qiankou) instrument. The other hand uses a pair of fine, pointed surgical forceps to manipulate a dark blue suture or ligature. The tissue being worked on is a deep red color, characteristic of liver tissue. The background shows more of the surgical field and some medical instruments. The overall lighting is bright and focused on the操作 site.

Two stage hepatectomy

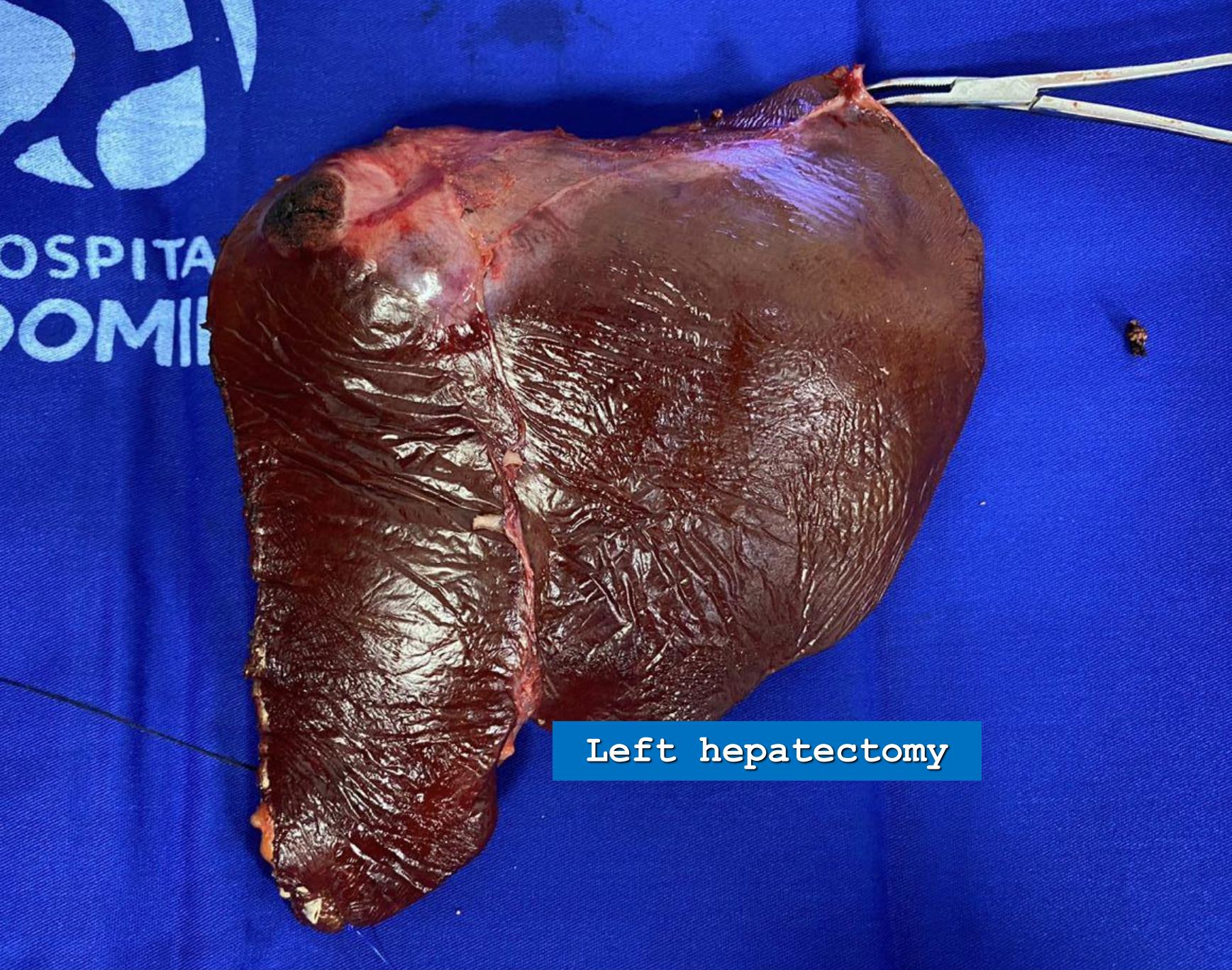
ALPPS

This image captures a complex surgical procedure on a liver. A large, dark, irregular mass, likely a tumor, is being resected from the central portion of the organ. The surrounding liver tissue is a vibrant red color. A blue rectangular box is overlaid on the image, containing the text "ALPPS" in white capital letters. The background shows the metallic surfaces of surgical instruments.

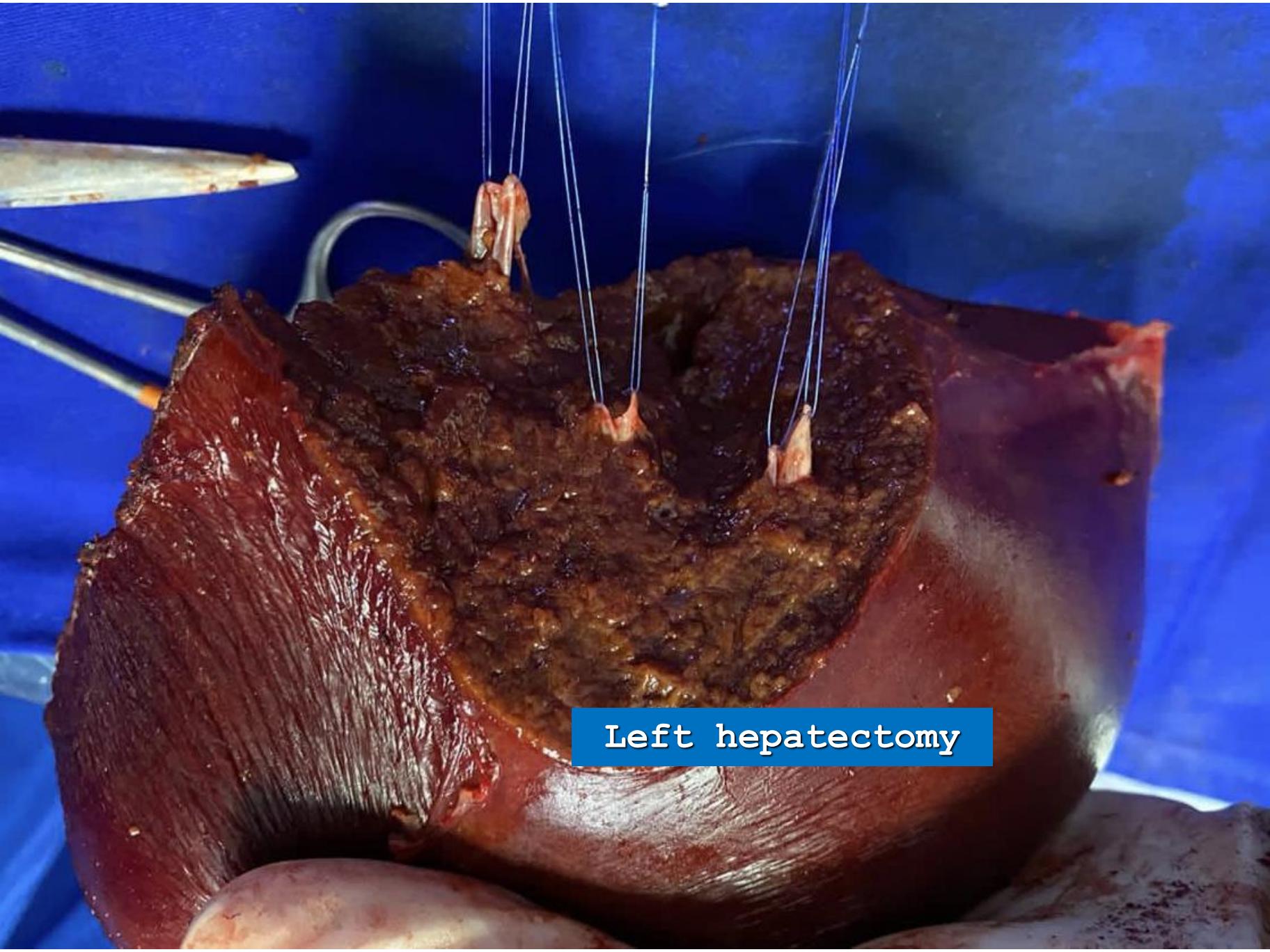
ALPPS

CASE 2

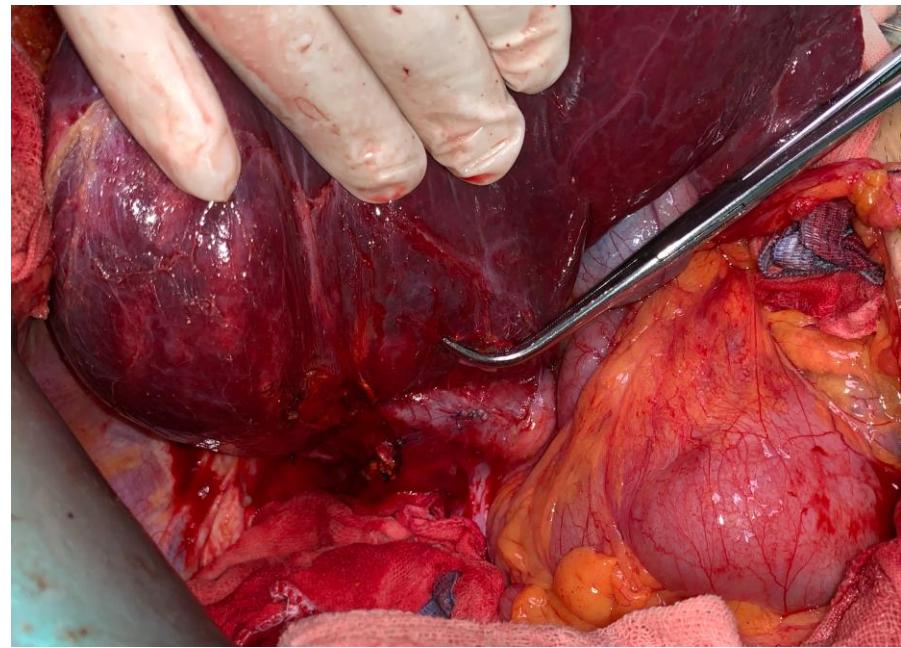
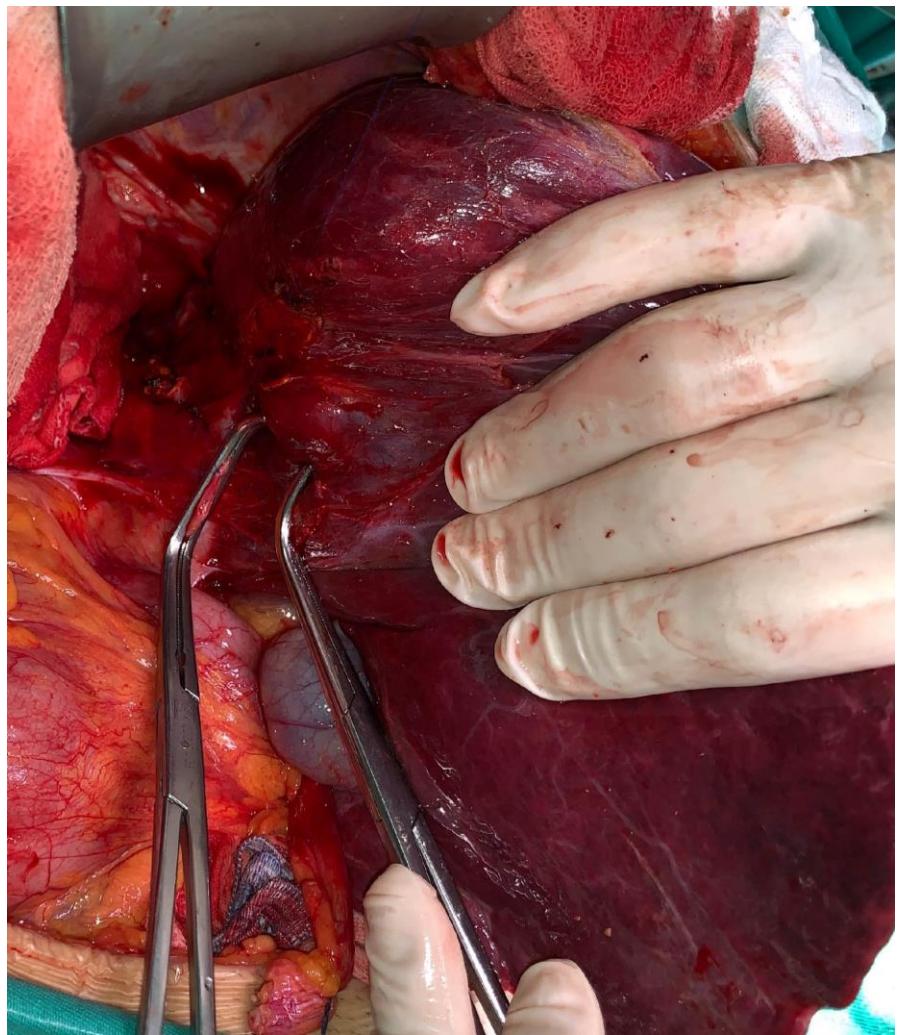
- 50-year-old female patient
 - Synchronous liver metastases
 - Left sided colon tumor
- The primary was previously resected:
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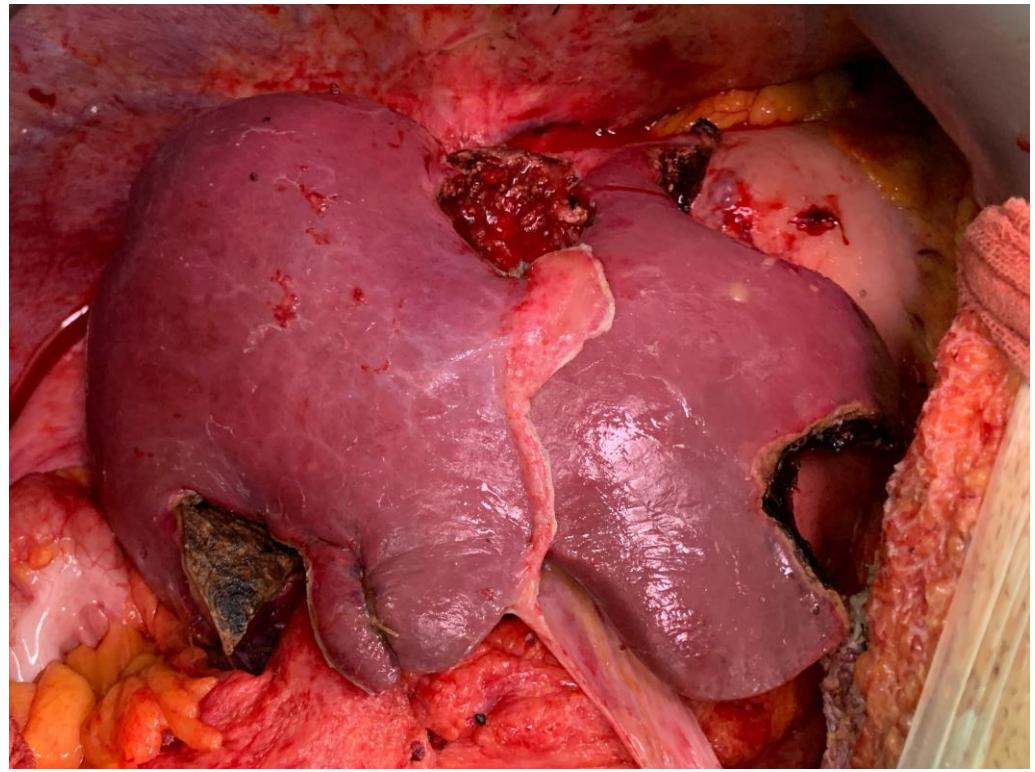
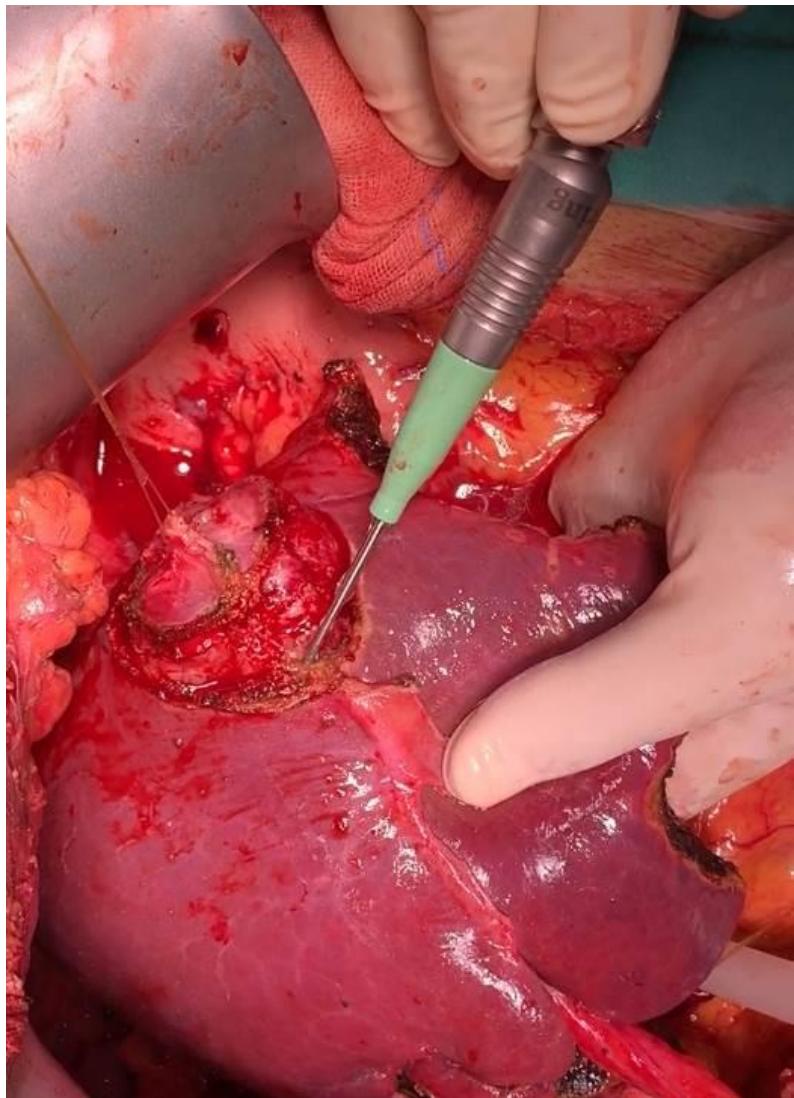
Left hepatectomy



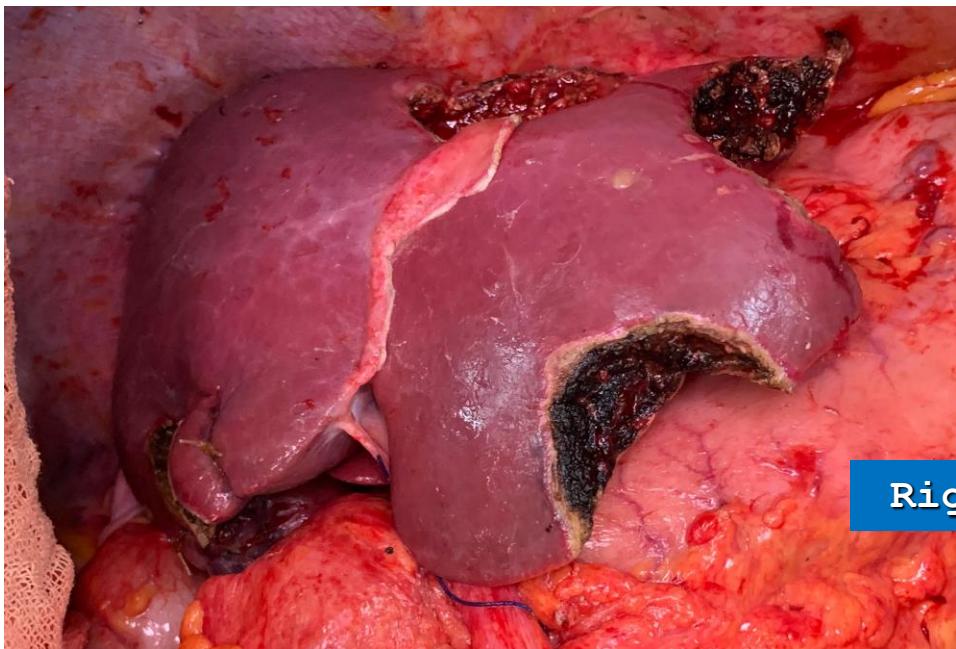
Left hepatectomy



Right hepatectomy + metastasectomy



Right hepatectomy + metastasectomy



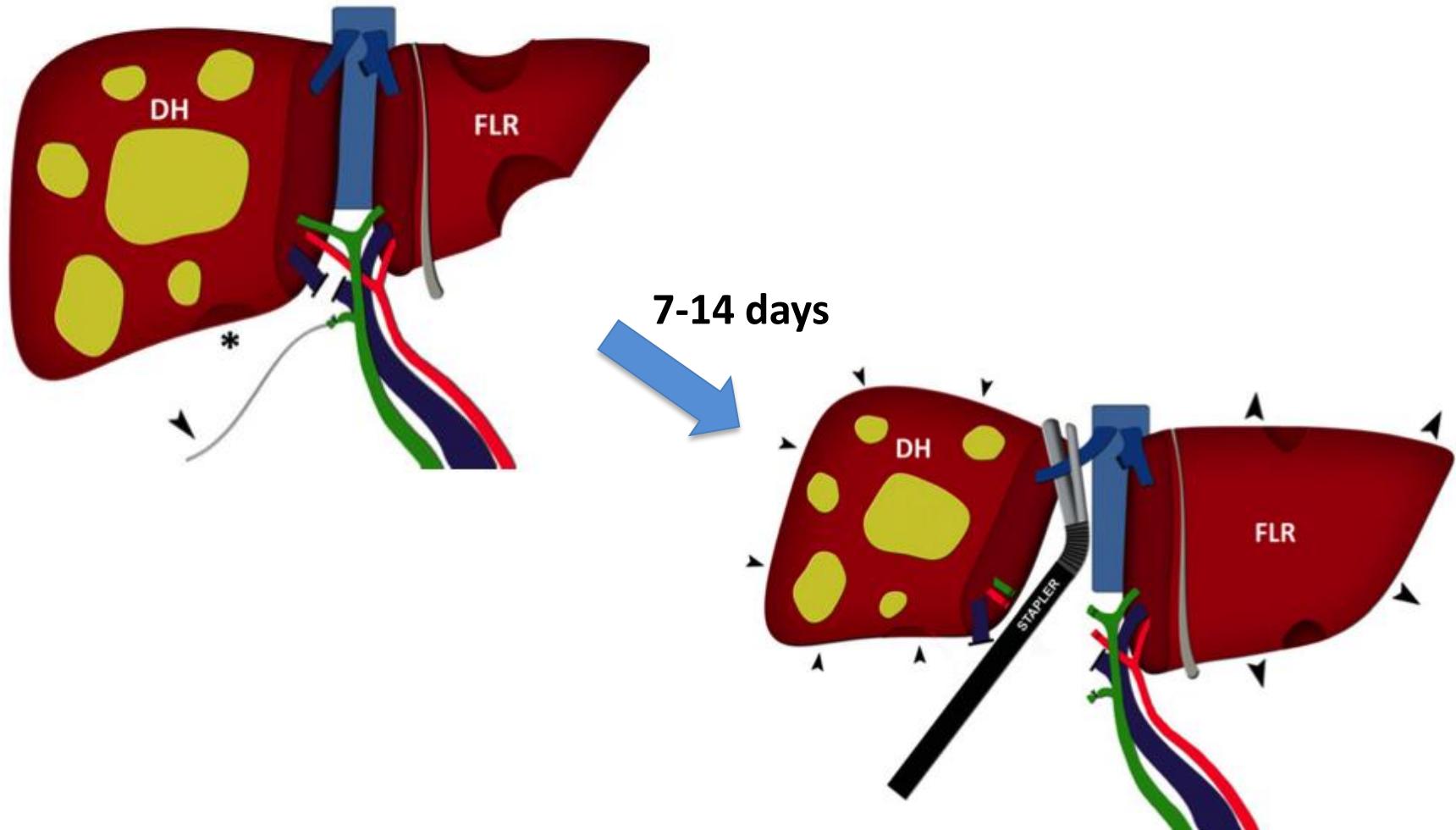
Right hepatectomy + metastasectomy

Right hepatectomy + metastasectomy

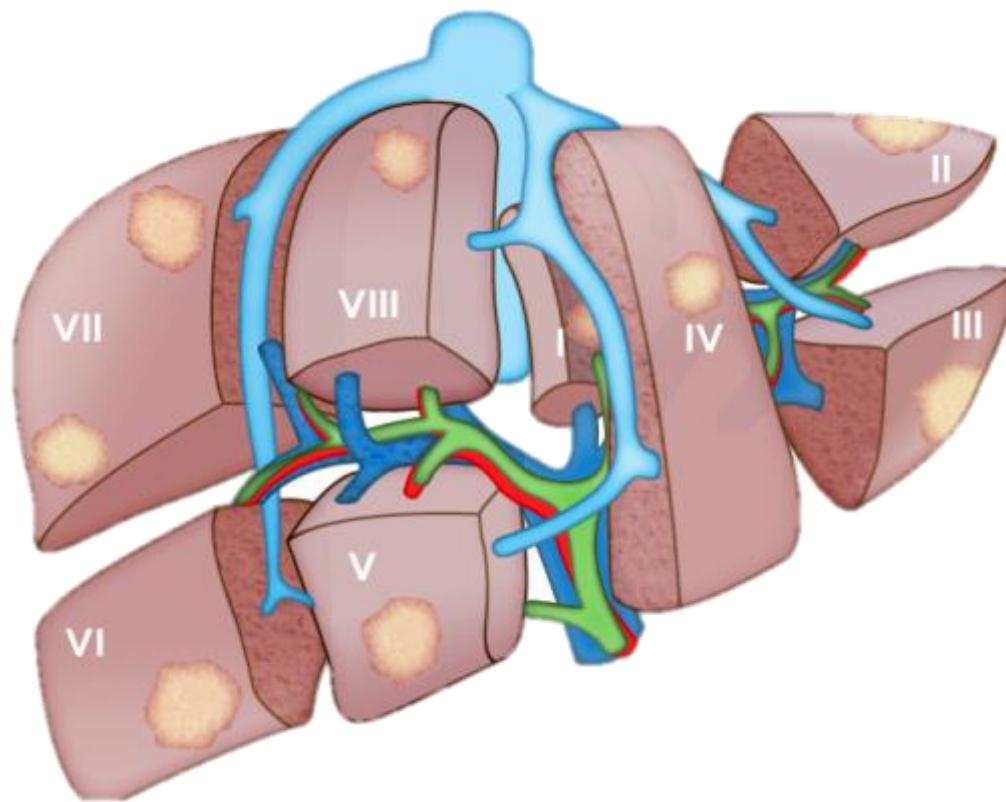
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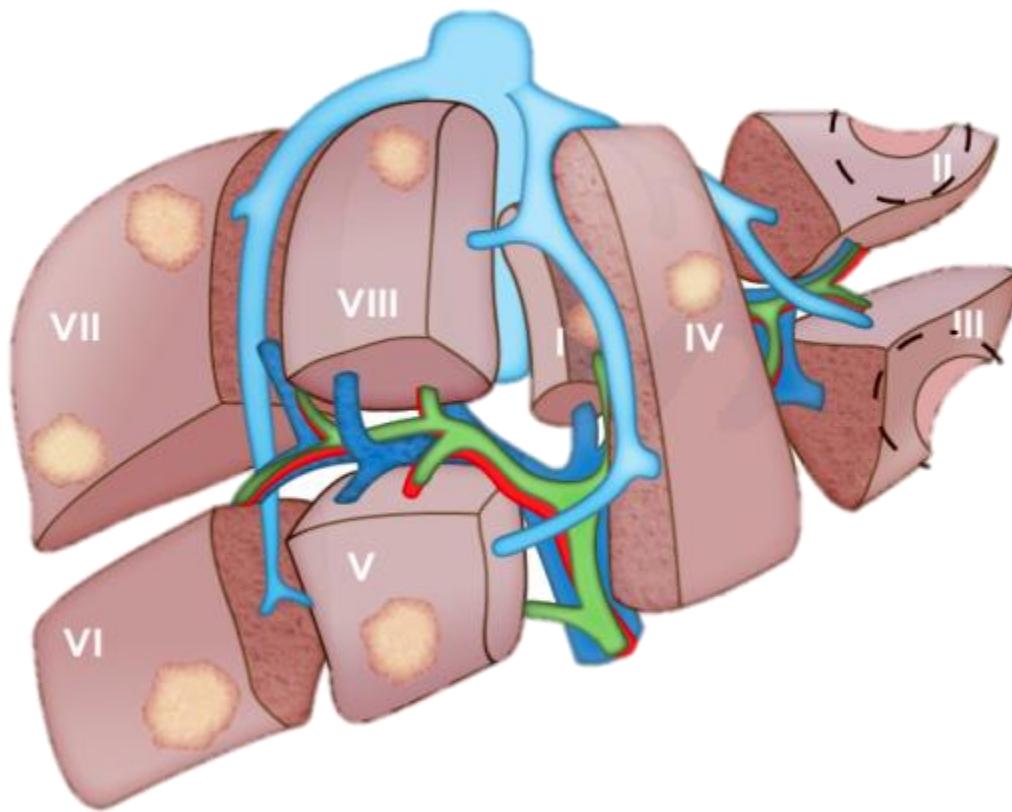
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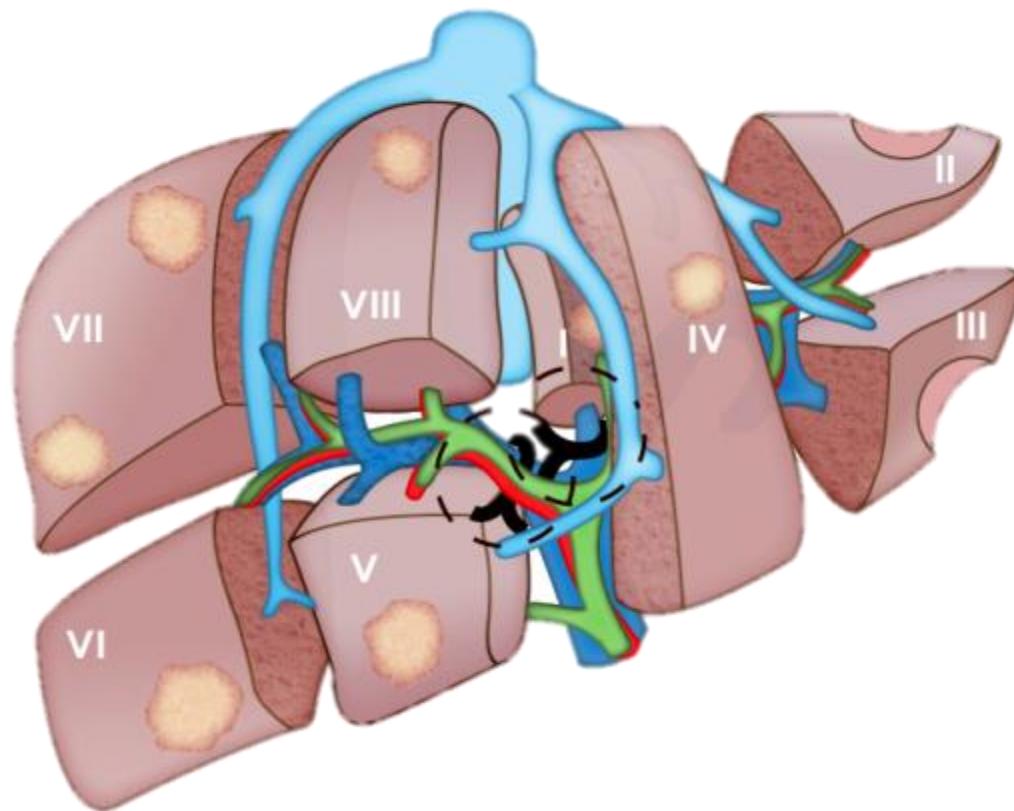
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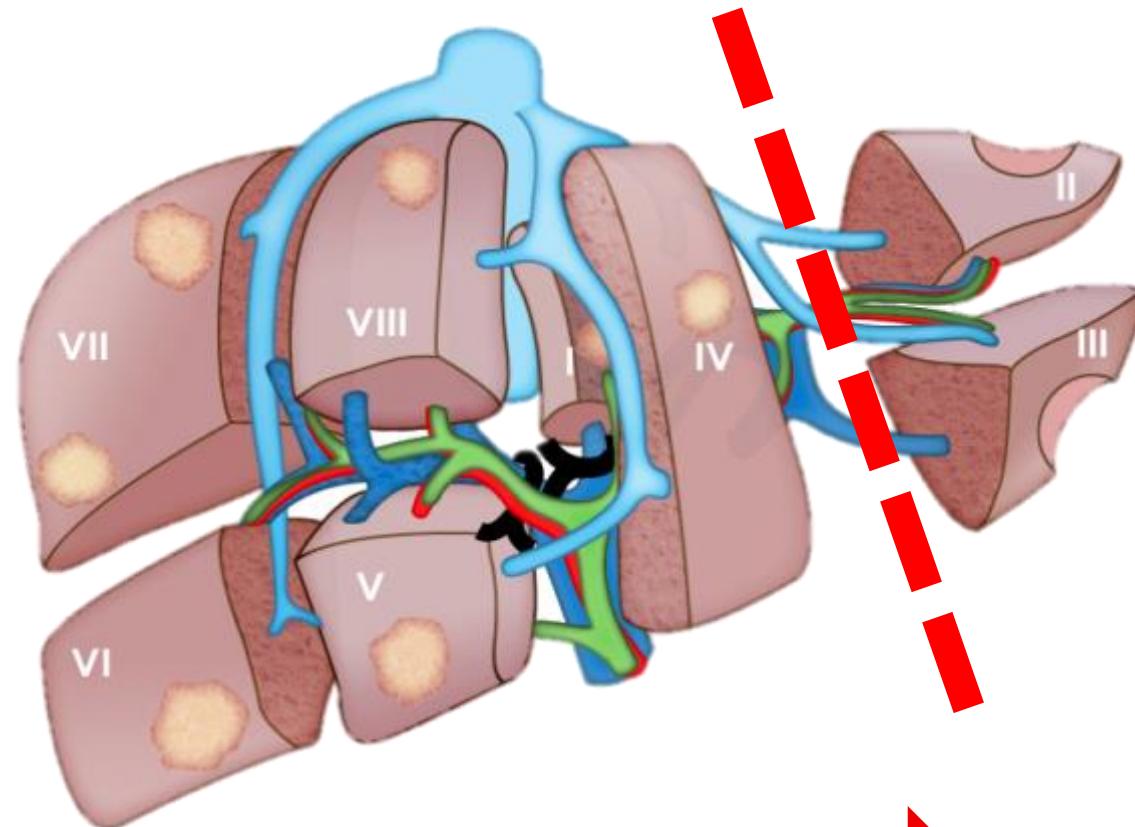
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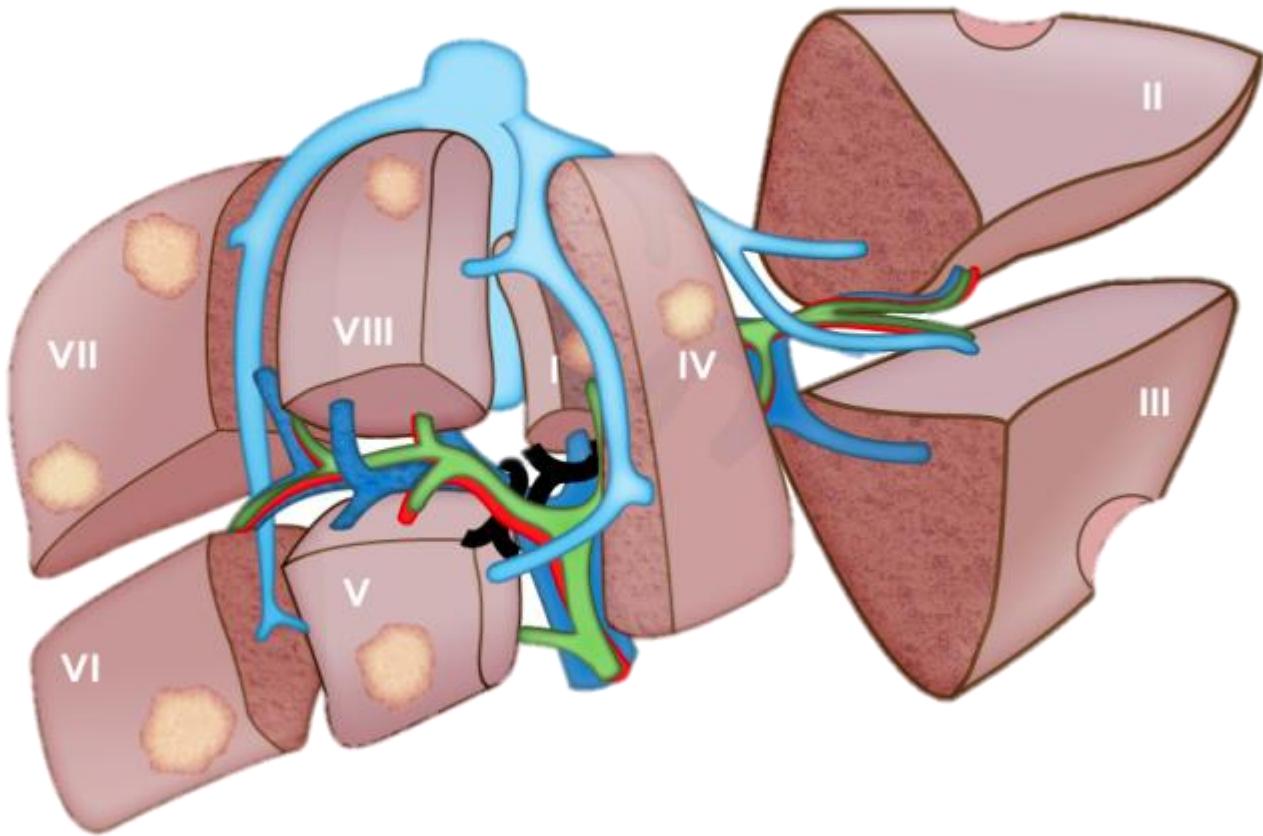
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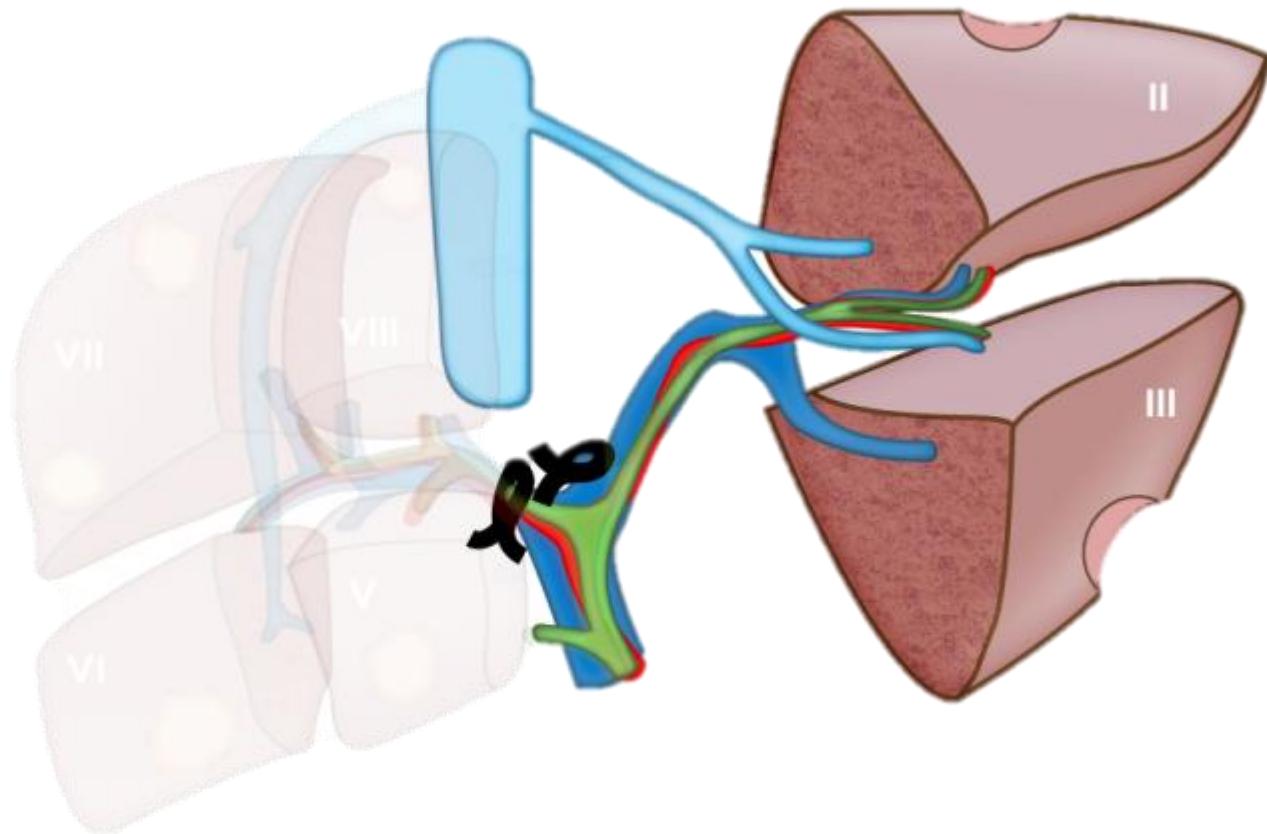
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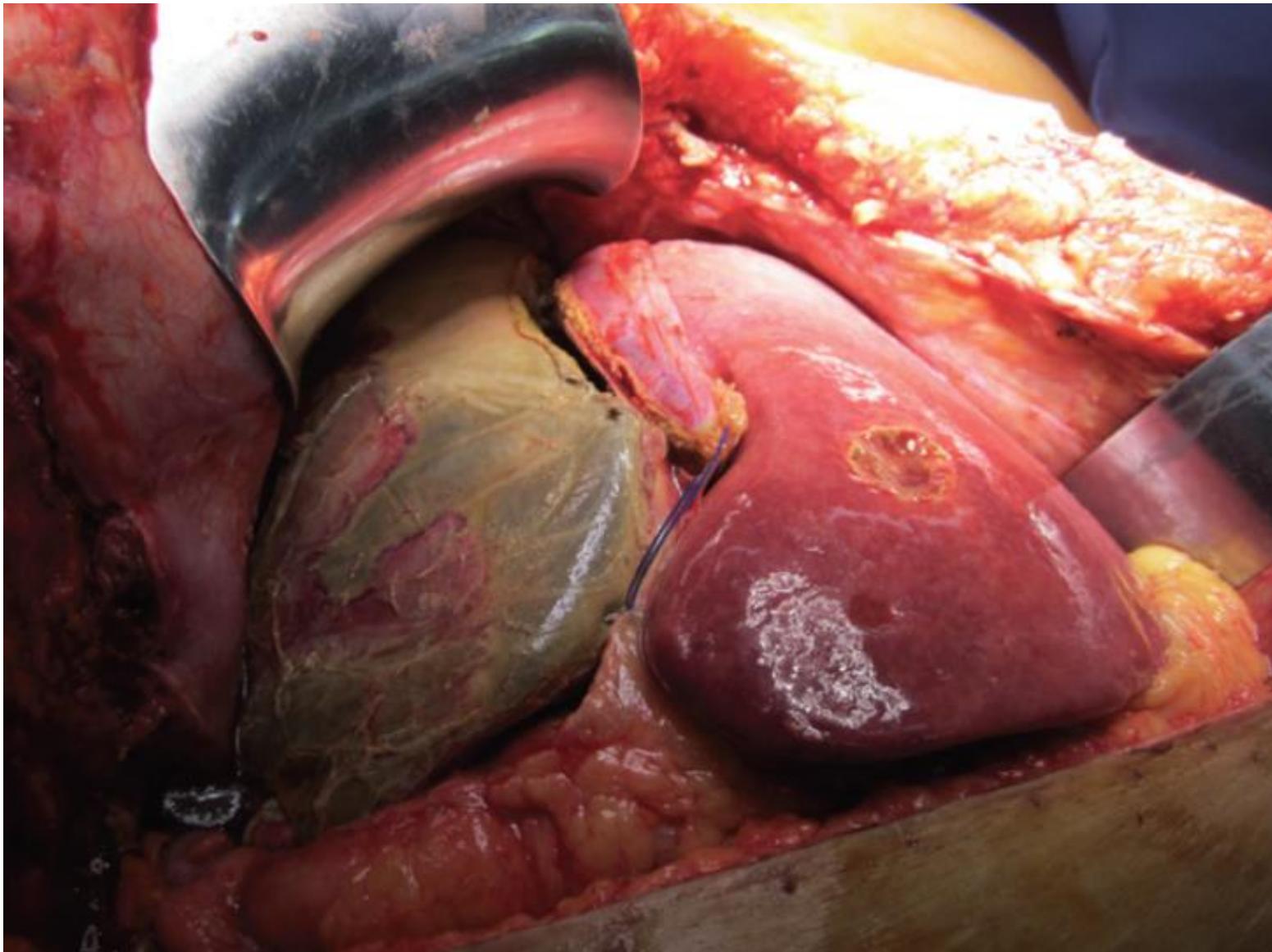
ALPPS



ALPPS



ALPPS



Courtesy Dr. Sanjay Govil (Bangalore - India)



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

Table 4 Outcomes in 172 patients with CRLM, treated with ALPPS upfront or PVE with rescue ALPPS on demand

Outcome	ALPPS (n=71)	PVE (n=101)	P
Successful resections, number (%)	60 (84.5)	74 (73.2)	0.080
sFLR before resection (IQR), %	35.5 (31.6–43.4)	32.3 (27.9–37)	<0.001
Volume increase of FLR (IQR), %	66.7 (46.8–96.4)	46.3 (31.7–73.8)	0.001
Complications CD 3a-5, number (%)	22 (31.0)	25 (24.8)	0.37
90-day mortality, number (%)	8 (11.3)	9 (8.9)	0.61
Reason for non-success, number			
Mortality	8	9	
Disease progression	1	10	
Insufficient sFLR		1	
Insufficient sFLR and progression		7	
Other	2		

CRLM, colorectal liver metastasis; ALPPS, associating liver partition and portal vein ligation for staged hepatectomy; PVE, portal vein embolization; sFLR, standardized future liver remnant; IQR, interquartile range; CD, Clavien-Dindo.



Article

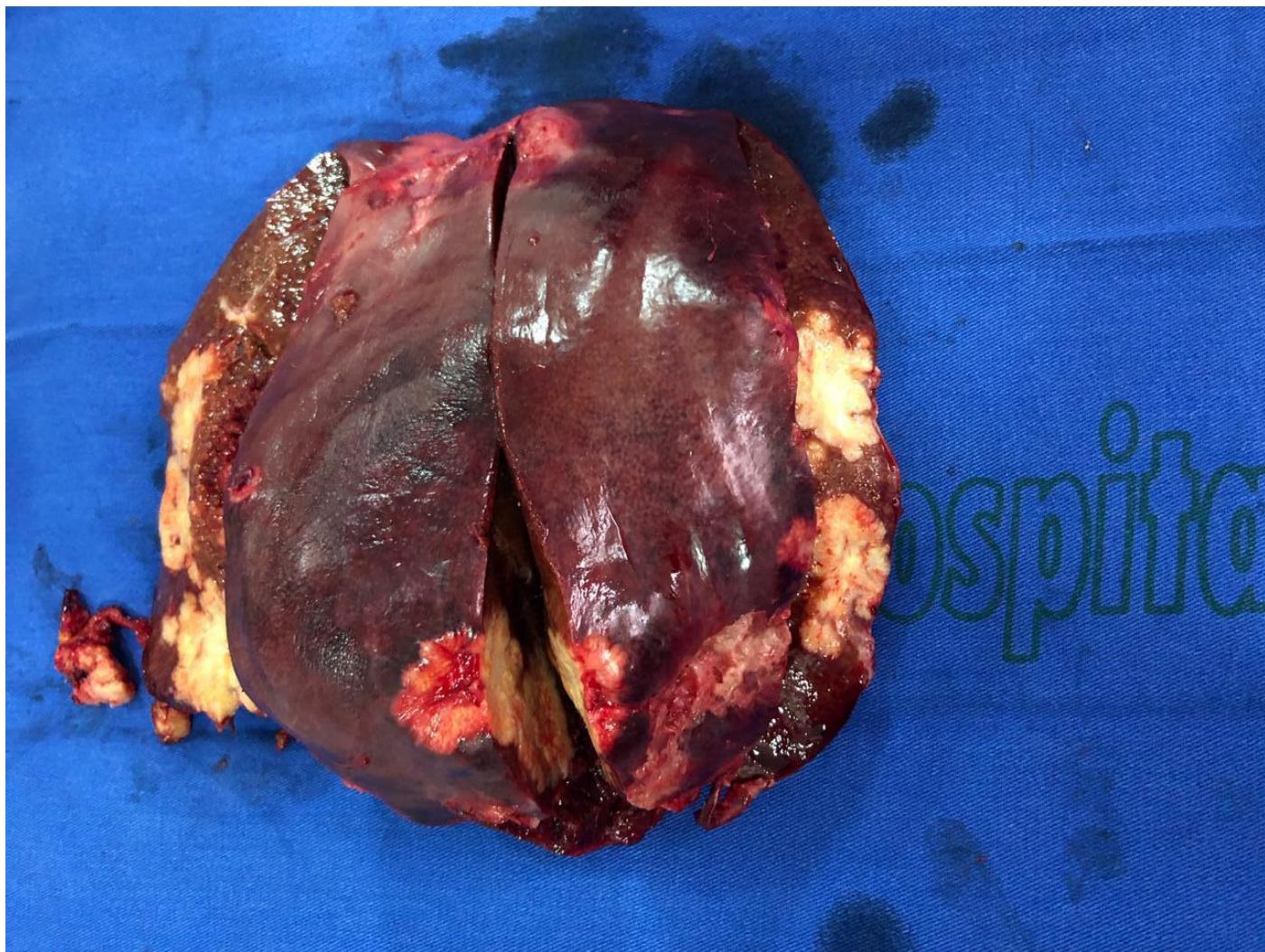
Rapid Induction of Liver Regeneration for Major Hepatectomy (REBIRTH): A Randomized Controlled Trial of Portal Vein Embolisation versus ALPPS Assisted with Radiofrequency

Table 3. FLRV before and after PVE or RALPPS.

	PVE (n = 24) (no chemo (4); chemo (20))	RALPPS (n = 26) (no chemo (4); chemo (n = 22))	p Value
Time from First-Stage Operation to Second CT (Median in days and range)	35 (21–75)	20 (14–36)	<0.001
Pre-Intervention FLRV (Mean \pm SD)			
no chemo	23.7 \pm 1.1	23.1 \pm 1.2	0.74
chemo	33.1 \pm 1.5	33.8 \pm 1.1	0.2
Post-Intervention FLRV (Mean \pm SD)			
no chemo	28.5 \pm 9.4	44.6 \pm 5.6	0.04
chemo	40.4 \pm 6.6	59.4 \pm 4.3	<0.001
Increase FLRV Post-Intervention (%)	18.4 \pm 9.8	80.7 \pm 13.7	<0.001

The FLRV was calculated depending on the type of hepatic resection needed to achieve tumor clearance by the proportion of future liver volume to TLV minus total liver tumor volume (FLRV = FLRV/TLV – TLT). Chemo: preoperative chemotherapy; no chemo: no preoperative chemotherapy.

Final resection: PVE 66.7% x 92.3% RALPPS (p= 0.007)



ASSOCIATING LIVER PARTITION AND PORTAL VEIN LIGATION FOR STAGED HEPATECTOMY (ALPPS): A NEW APPROACH IN LIVER RESECTIONS

Ligadura da veia porta associada à transecção para hepatectomia em dois estágios (ALPPS): uma nova abordagem nas ressecções hepáticas

Orlando Jorge Martins **TORRES**, José Maria Assunção **MORAES-JUNIOR**, Nádia Caroline Lima e **LIMA**, Anmara Moura **MORAES**

From the Department of Digestive Surgery,
UDI Hospital, São Luis, MA, Brazil.

ABSTRACT – Background - Postoperative liver failure consequent to insufficiency of remnant liver is a feared complication in patients who underwent extensive liver

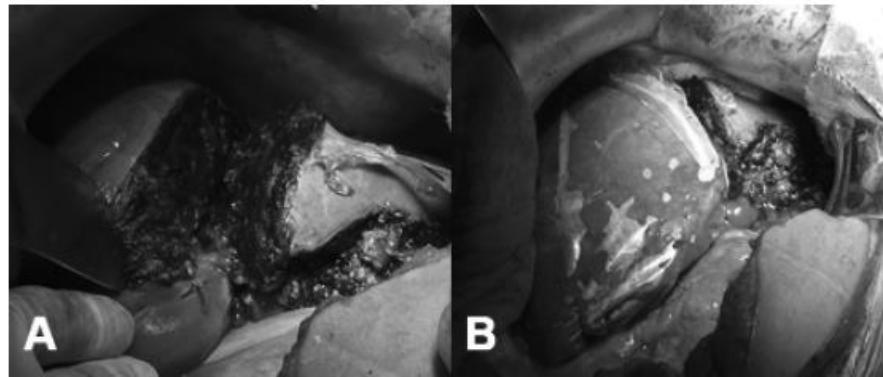


FIGURE 1 - A - Transection of the liver; B - protection with sterile bag



FIGURE 2 - Final aspect of the surgical procedure

HOW-I-DO-IT ARTICLES

Inverting the ALPPS paradigm by minimizing first stage impact: the Mini-ALPPS technique

Eduardo de Santibañes^{1,2} • Fernando A. Alvarez¹ • Victoria Ardiles¹ • Juan Pekolj¹ •
Martin de Santibañes¹



HOW-I-DO-IT ARTICLES

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Table 1 Patients characteristics and volumetric data

Patient	Sex	Age	Diagnosis	Preop chemotherapy (cycles)	Hepatectomy type	FLR/TLV (%) pre	FLR pre (cc)	FLR post (cc)	Hypertrophy (%)	KGR (cc/day)	Interval (days) ^a
1	Female	66	HCC	–	RTS	40	510	778	52.5	26.8	10
2	Female	71	CRLM	FOLFOX (6)	RTS + FLR clean-up	23	235	420	78.7	12.3	15
3	Female	44	CRLM	FOLFOX + BEV (6)	RTS + FLR clean-up	27	300	427	70	9.8	13
4	Male	61	CRLM	FOLFOX (4)/FOLFIRI + BEV (3)	RH + FLR clean-up	28	530	792	49.4	43.6	6

HCC hepatocellular carcinoma, CRLM colorectal liver metastases, BEV bevacizumab, RTS right trisectionectomy, RH right hepatectomy, FLR future liver remnant, KGR Kinetic growth rate

^a Internal between the first stage and the last volumetric evaluation before the second stage

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

Andreas A. Schnitzbauer, MD, Sven A. Lang, MD,* Holger Goessmann, MD,† Silvio Nadalin, MD,§*

Janine Baumgart, MD,|| Stefan A. Farkas, MD, Stefan Fichtner-Feigl, MD,* Thomas Lorf, MD,¶*

Armin Goralcyk, MD,¶ Rüdiger Hörbelt, MD,# Alexander Kroemer, MD, Martin Loss, MD,* Petra Rümmele, MD,‡*

Marcus N. Scherer, MD, Winfried Padberg, MD,# Alfred Königsrainer, MD,§ Hauke Lang, MD,||*

*Aiman Obed, MD,¶ and Hans J. Schlitt, MD**

ABCDDV/898

ABCD Arq Bras Cir Dig
2013;26(1):40-43

Original Article

ASSOCIATING LIVER PARTITION AND PORTAL VEIN LIGATION FOR STAGED HEPATECTOMY (ALPPS): THE BRAZILIAN EXPERIENCE

Ligadura da veia porta associada à bipartição do fígado para hepatectomia em dois estágios (ALPPS): experiência Brasileira

*Orlando Jorge Martins TORRES¹, Eduardo de Souza Martins FERNANDES² Cassio Virgilio Cavalcante OLIVEIRA³,
Cristiano Xavier LIMA⁴, Fabio Luiz WAECHTER⁵, Jose Maria Assunção MORAES-JUNIOR¹,
Marcelo Moura LINHARES⁶, Rinaldo Danese PINTO⁷, Paulo HERMAN⁸, Marcel Autran Cesar MACHADO⁹*

- 59 and 64% - Morbidity
- 12 and 12.8% - Mortality

TABLE 108D.1 Degree of Hypertrophy After Stage 1 of ALPPS Procedure

Series	No. Patients	Interval Stage (mean days)	Degree of Hypertrophy (%)
Schnitzbauer et al, 2012	25	9	74
Knoefel et al, 2013	7	6	63
Li et al, 2013	9	13	87.20
Nadalin et al, 2014	15	10	87.2
Torres et al, 2013	39	14.1	83
Robles Campos et al, 2014	22*	7	61
Alvarez et al, 2015	30	6	89.7
Hernandez-Alejandro et al, 2015	14	8	93

*Associating liver tourniquet and portal ligation for staged hepatectomy (ALTPS).

ALPPS, Associating liver partition and portal vein ligation for staged hepatectomy.

BRAZILIAN CONSENSUS FOR MULTIMODAL TREATMENT OF COLORECTAL LIVER METASTASES. MODULE 3: CONTROVERSIES AND UNRESECTABLE METASTASES

*Consenso brasileiro de tratamento multidisciplinar de metástase hepática de origem colorretal
Módulo 3: Controvérsias e metástases irreessecáveis*

Orlando Jorge Martins **TORRES**^{1,2,6}, Márcio Carmona **MARQUES**^{2,6}, Fabio Nasser **SANTOS**¹, Igor Correia de **FARIAS**^{2,6},
Anelisa Kruschewsky **COUTINHO**³, Cássio Virgílio Cavalcante de **OLIVEIRA**^{1,4,5}, Antonio Nocchi **KALIL**^{1,2,4,6},
Celso Abdón Lopes de **MELLO**³, Jaime Arthur Pirola **KRUGER**^{1,4,5,6}, Gustavo dos Santos **FERNANDES**³,
Claudemiro **QUIREZE JR**^{1,4,5,6}, André M. **MURAD**³, Milton José de **BARROS E SILVA**³,
Charles Edouard **ZURSTRASSEN**^{*}, Helano Carioca **FREITAS**³, Marcelo Rocha **CRUZ**³, Rui **WESCHENFELDER**³,
Marcelo Moura **LINHARES**^{1,4,5,6}, Leonaldson dos Santos **CASTRO**^{1,2,6}, Charles **VOLLMER**⁶,
Elijah **DIXON**⁶, Héber Salvador de Castro **RIBEIRO**^{1,2,6}, Felipe José Fernandez **COIMBRA**^{1,2,5,6}

ALPPS

❑ Alternative for two-stage hepatectomy

❑ Rescue surgery – after PVE

ALPPS, p-ALPPS e Mini-ALPPS:
como e para quem

ASSOCIATING LIVER PARTITION AND PORTAL VEIN LIGATION FOR STAGED HEPATECTOMY (ALPPS): THE BRAZILIAN EXPERIENCE

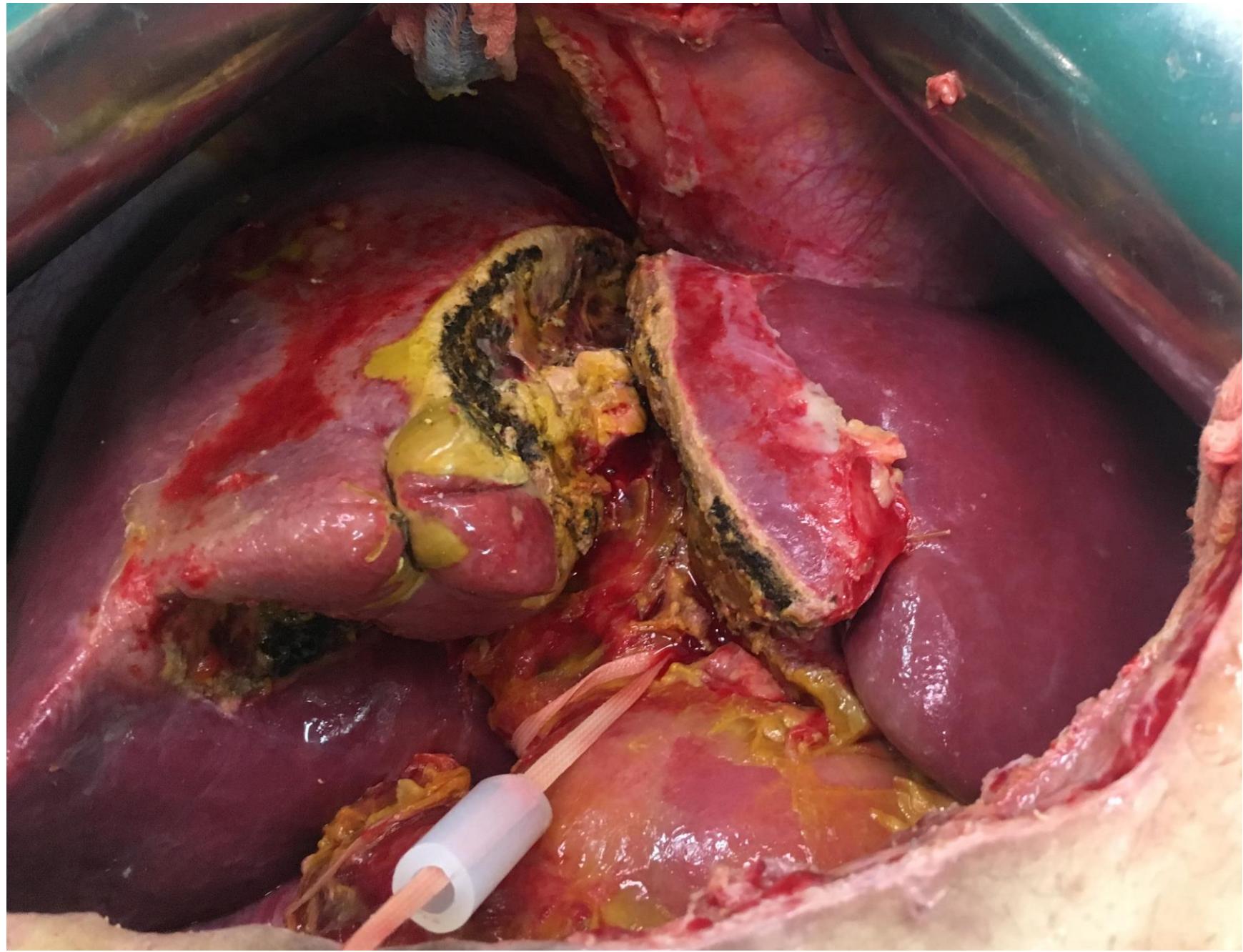
Ligadura da veia porta associada à bipartição do fígado para hepatectomia em dois estágios (ALPPS): experiência Brasileira

Orlando Jorge Martins **TORRES¹**, Eduardo de Souza Martins **FERNANDES²** Cassio Virgilio Cavalcante **OLIVEIRA³**,
Cristiano Xavier **LIMA⁴**, Fabio Luiz **WAECHTER⁵**, Jose Maria Assunção **MORAES-JUNIOR¹**,
Marcelo Moura **LINHARES⁶**, Rinaldo Danese **PINTO⁷**, Paulo **HERMAN⁸**, Marcel Autran Cesar **MACHADO⁹**

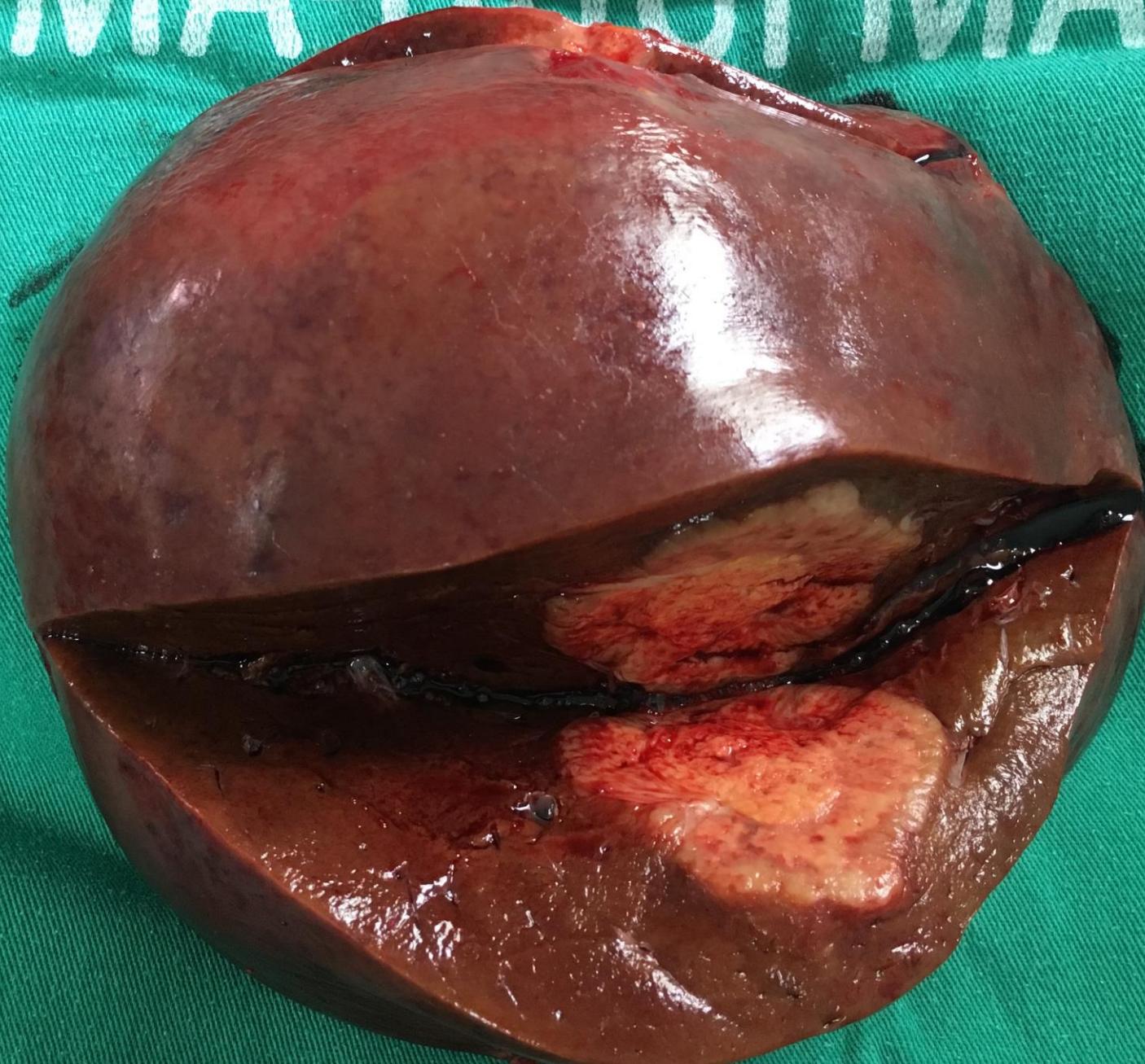
TABLE 1 - Complications after ALPPS approach

Complications	n	%
Surgical site infection	8	20.5
Ascites	5	12.8
Biliary fistula	4	10.2
Pneumonia	4	10.2
Abdominal hernia	4	10.2
Sepsis	3	7.7
Acute renal failure	2	5.1
Bile duct injury	1	2.5
Hepatic artery thrombosis	1	2.5
Acute liver failure	1	2.5
Others	9	23.0

□ Mortality 12.8%

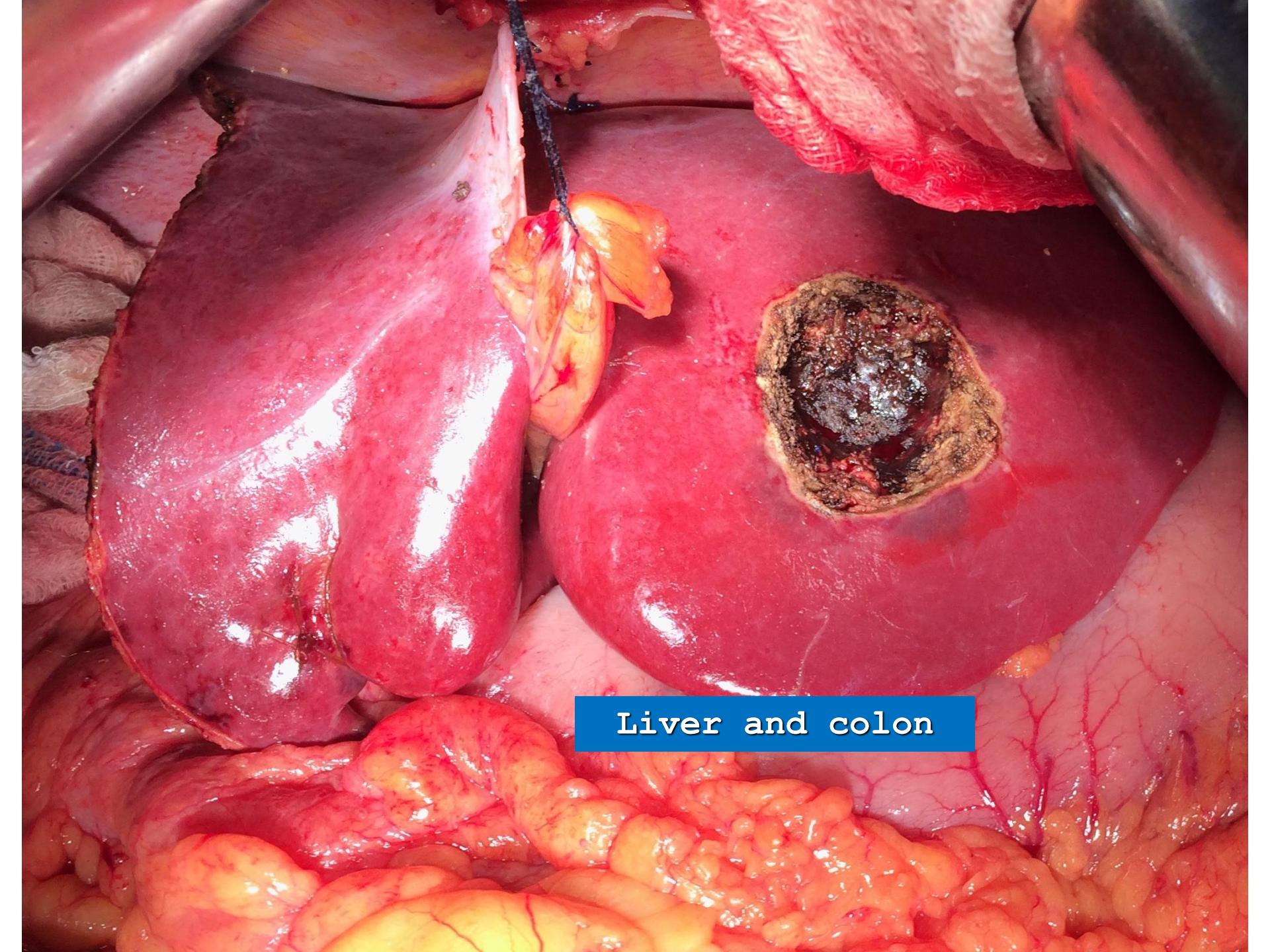


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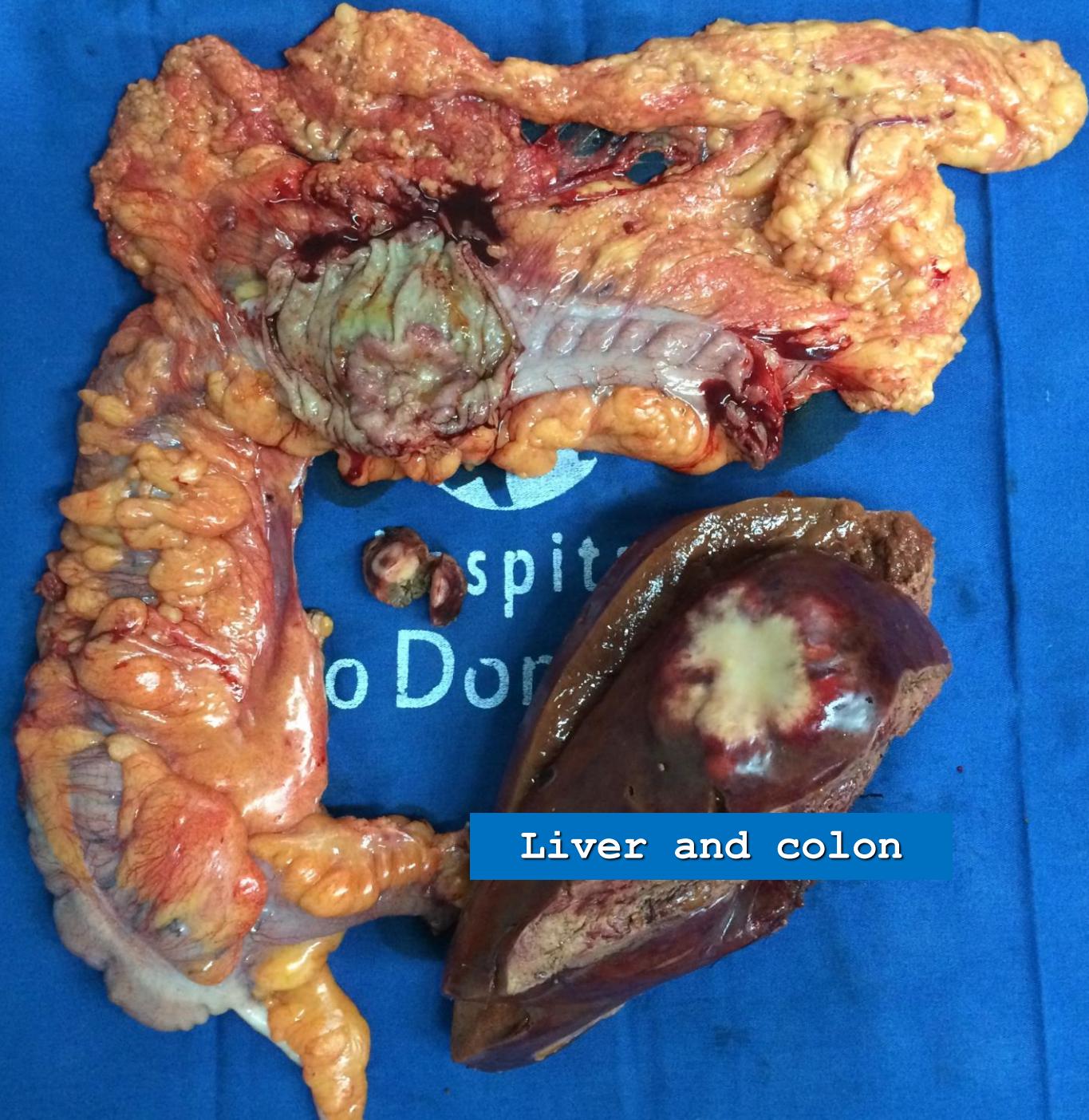




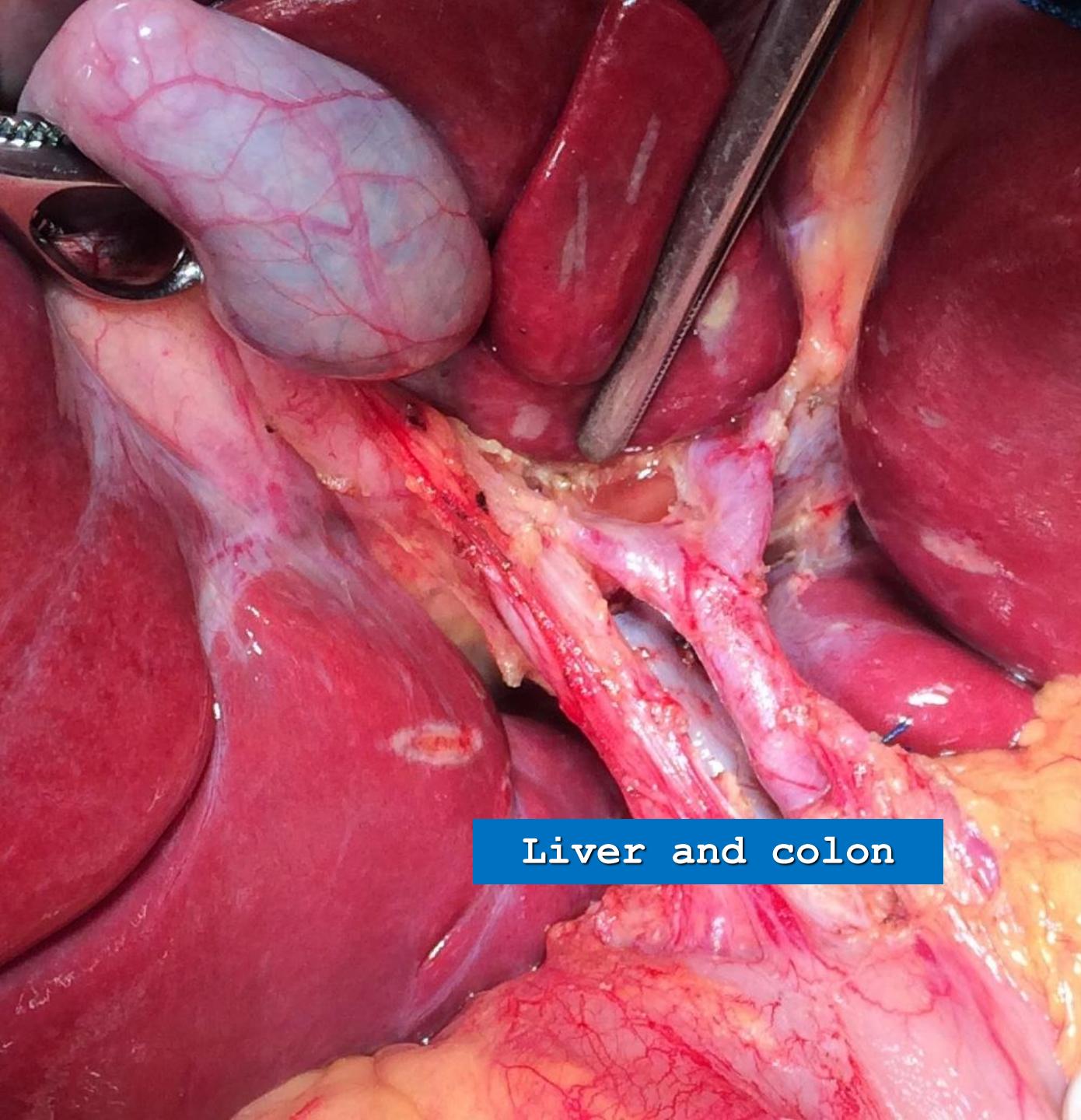
Liver and colon



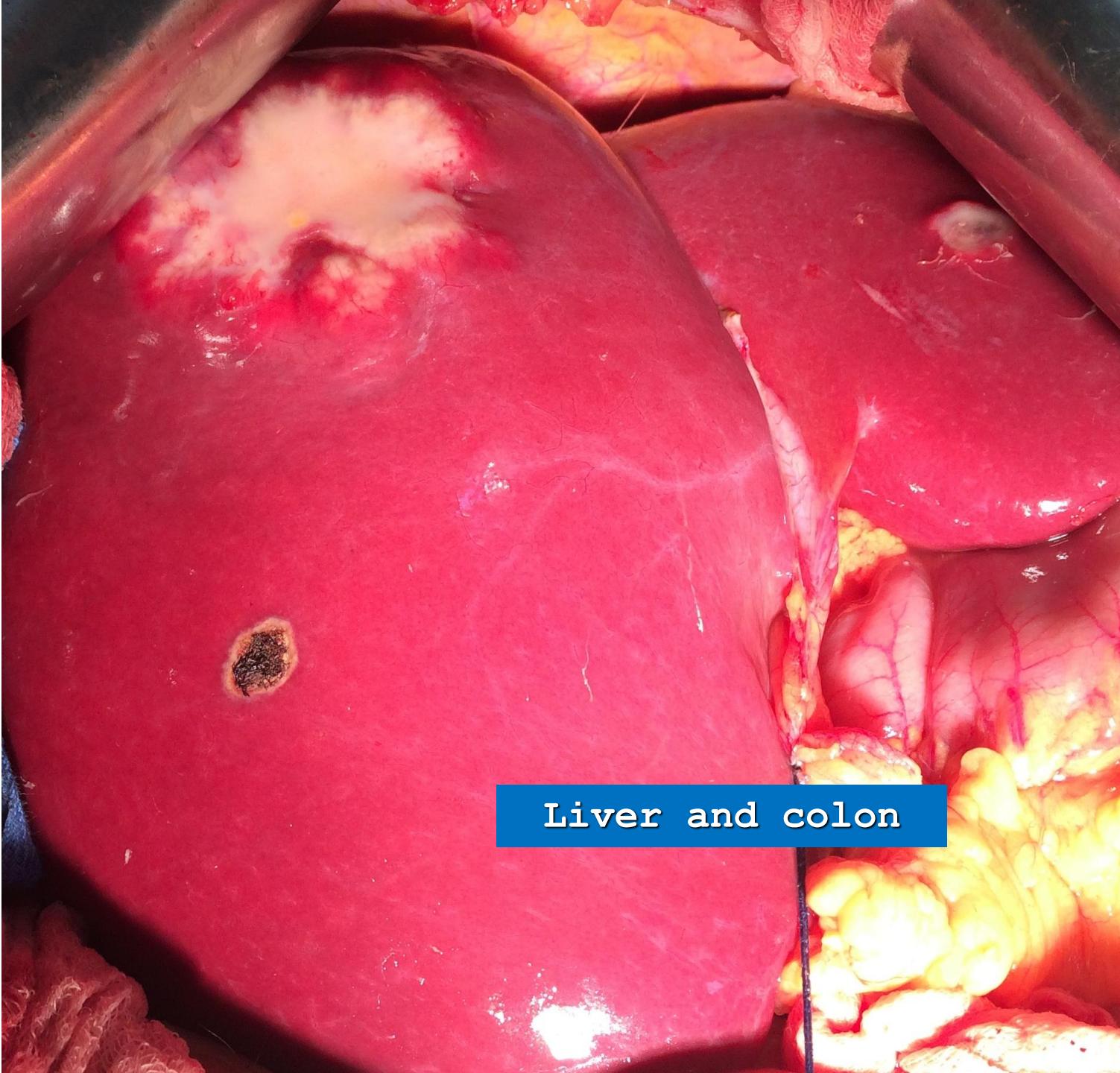
Liver and colon



Liver and colon



Liver and colon



Liver and colon



Liver and colon

CASE 1

**ALPPS FOR METASTASIS IN SEGMENTS
I, II, III, IV, V, VII, AND VIII**

CASE 1

- 52-year-old female patient
 - Synchronous liver metastases
 - Left sided colon tumor
- The primary was asymptomatic.
- She underwent:
 - Left colectomy
 - Lymphadenectomy
 - Colostomy
- No chemotherapy

KRAS Wild-type

ADENOCARCINOMA



□ Liver metastases:

Segment: I

Involving the vena cava

Segments: II, III, IVa, V, VII, VIII

Chemotherapy

□ Nine cycles of FOLFIRI

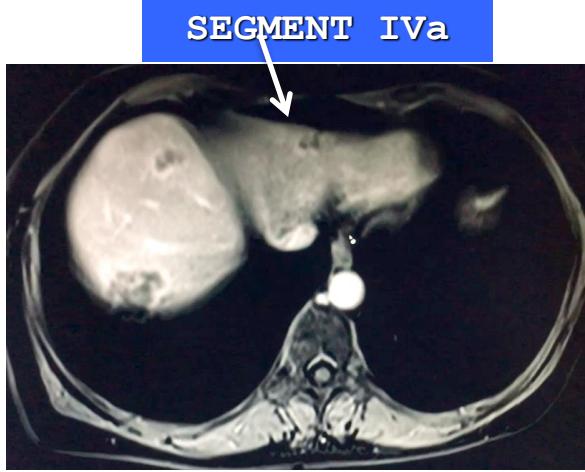
MRI

□ After 8 months

SEGMENT III



SEGMENT IVa



SEGMENT II



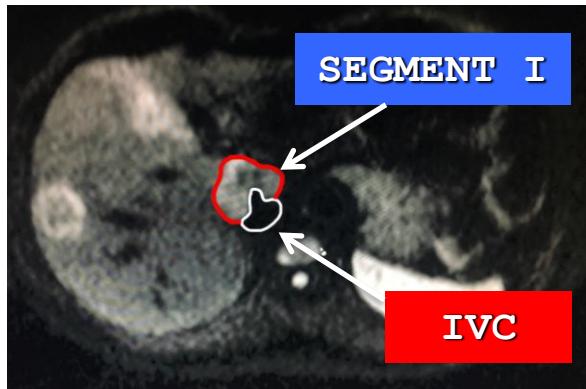
SEGMENT V/VIII



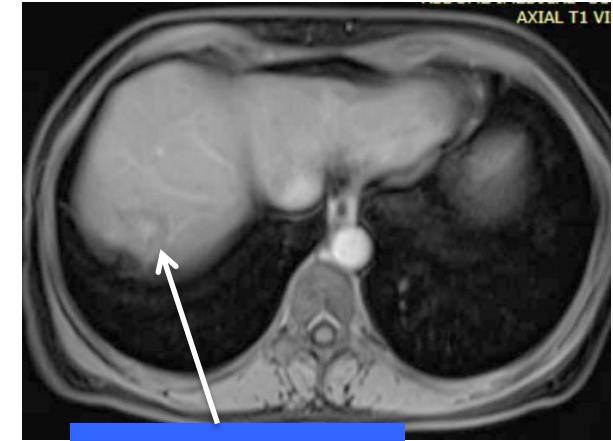
SEGMENT IVa/b



SEGMENT I



SEGMENT VII



MRI

Stable disease

CEA

Before chemotherapy

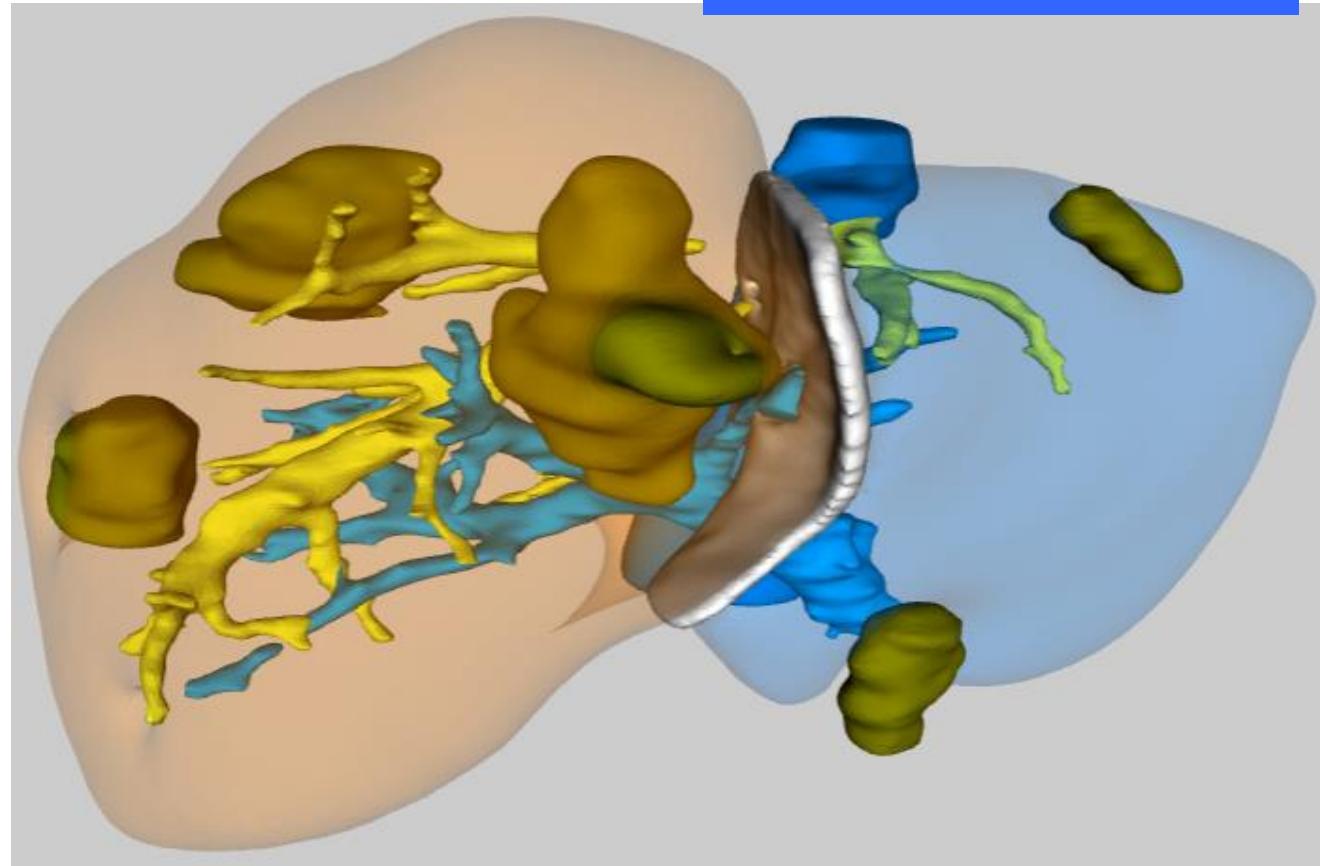
CEA - 142 ng/L

After chemotherapy

CEA - 3.2 ng/L

VOLUMETRY

Liver 865.5 ml
 FLR 204.2 ml



Segments 2/3

FLR 23.6%



Name [REDACTED]

Gender, Age F, 052Y, 14373556

Date 30.11.2019

Liver View

Serie/s View Liver

Liver :865.5 ml

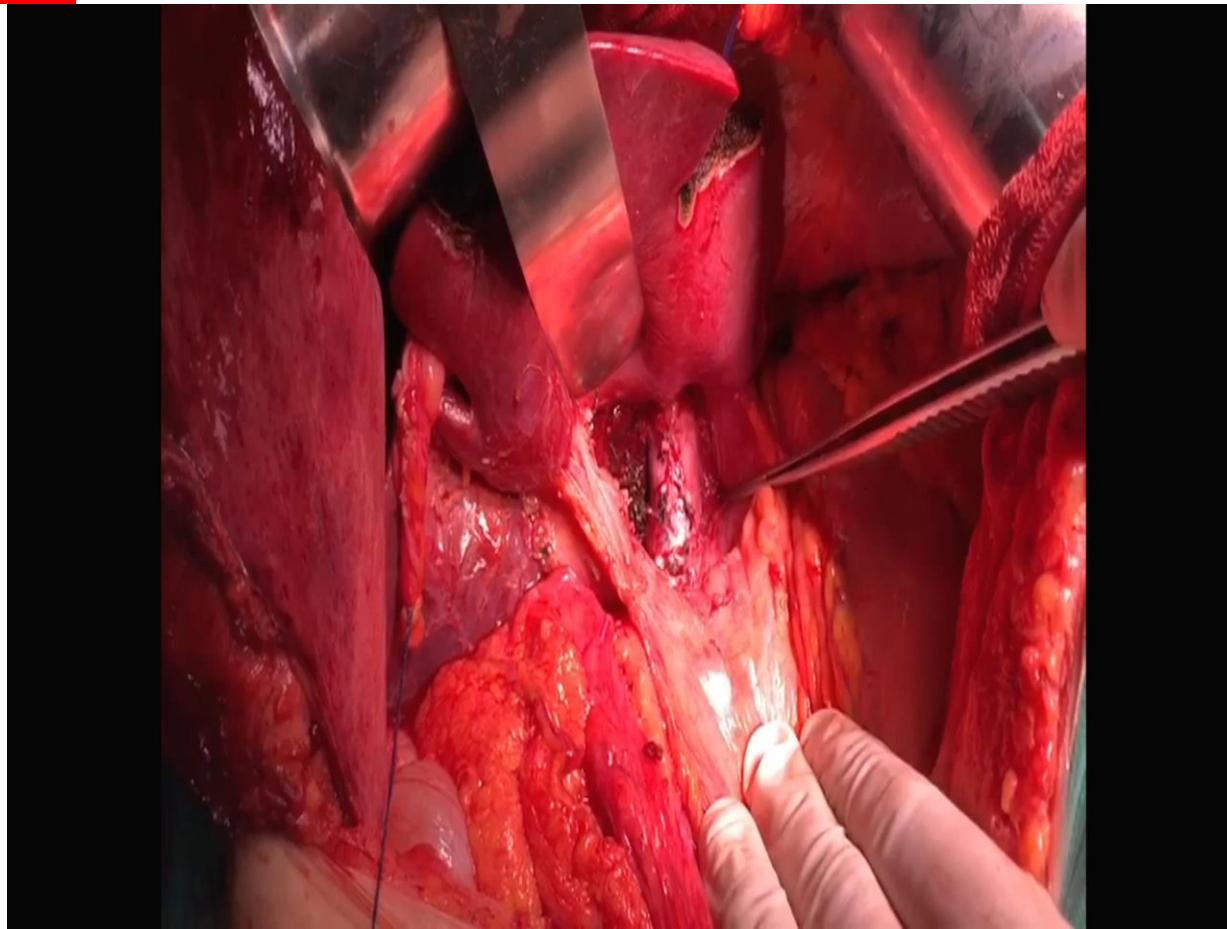
Cut Liver :649.4 ml / %75.0

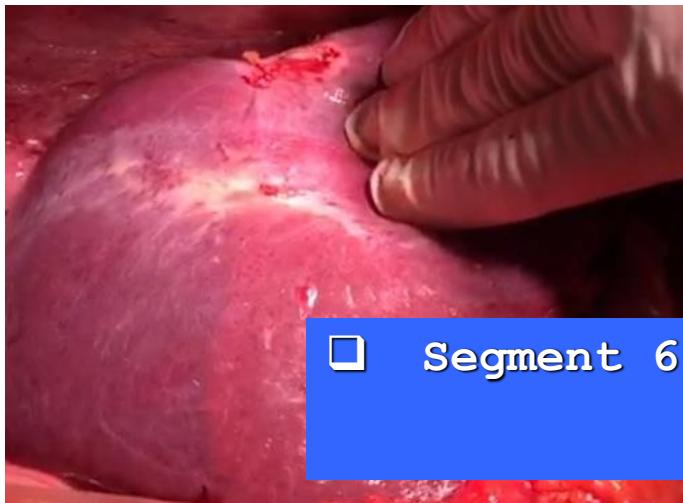
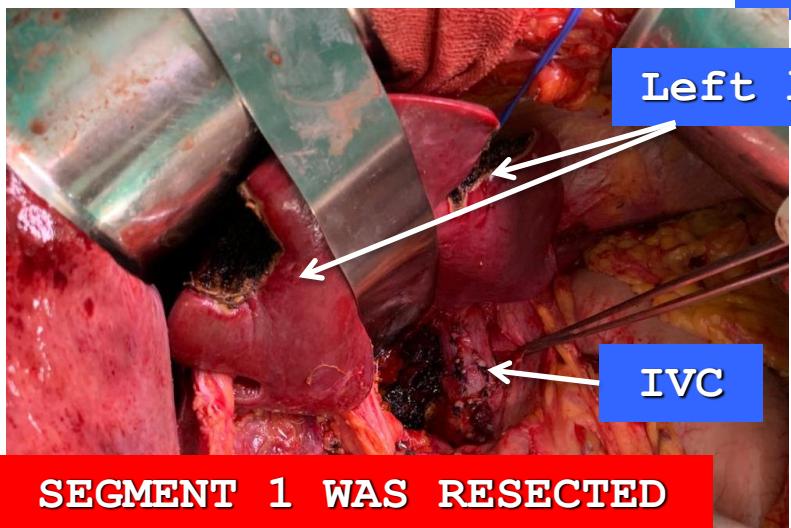
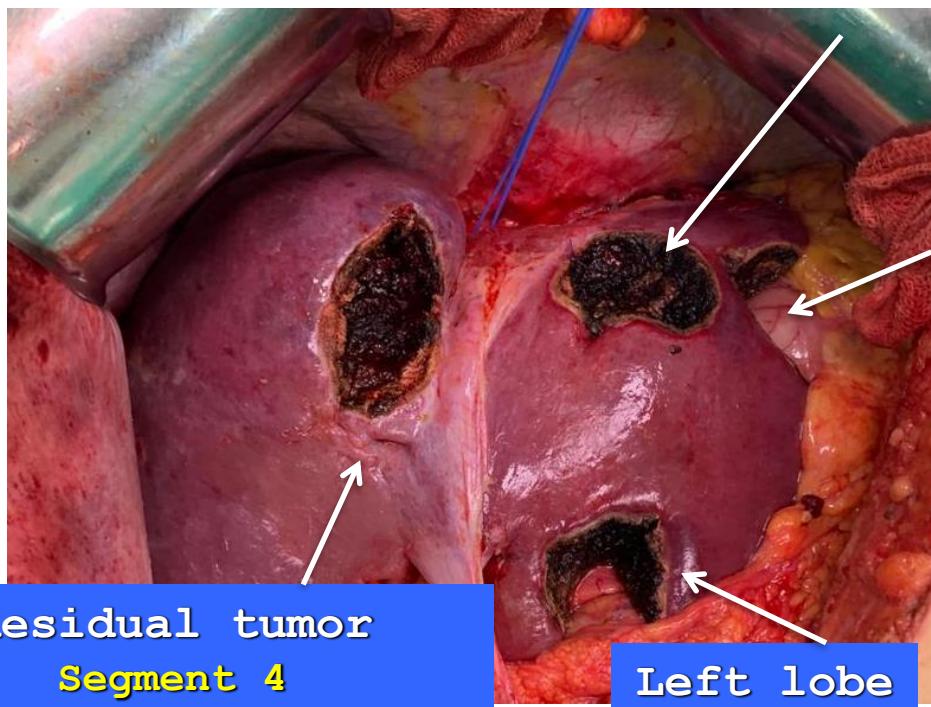
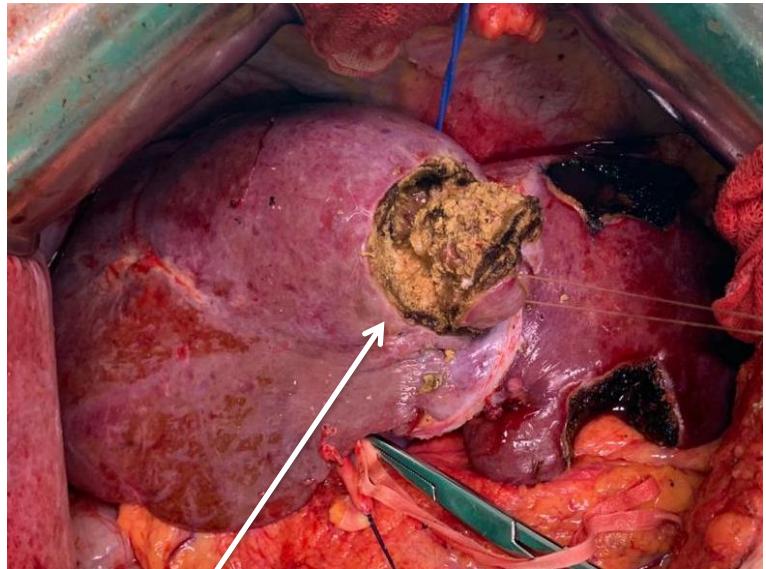
FLR :204.2 ml / %23.6

Courtesy: Prof. Deniz Balci (Ankara - Turkey)

Caudate

- Resected
- IVC





After 4 weeks

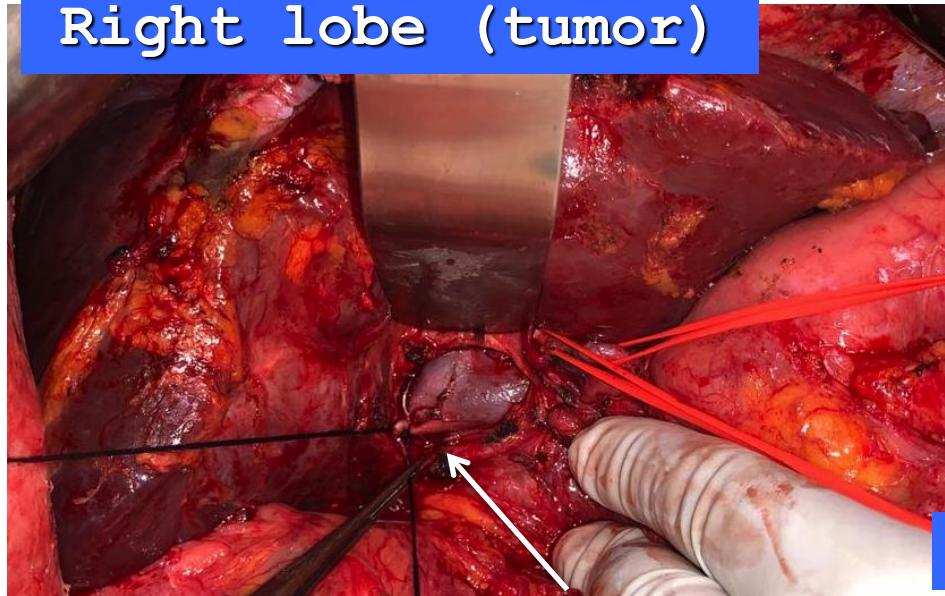
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Reoperation
ALPPS

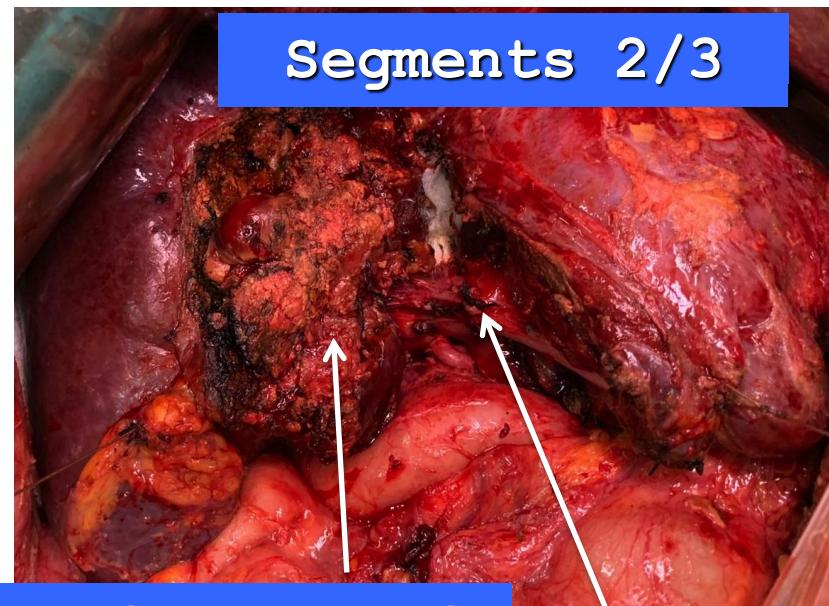


Right lobe (tumor)



Right portal vein was ligated

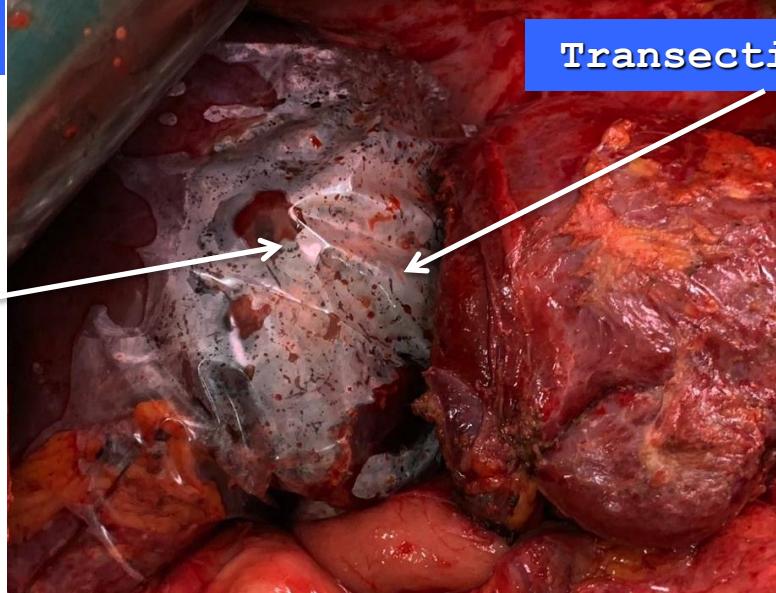
Segments 2/3



Plastic bag (tumor)

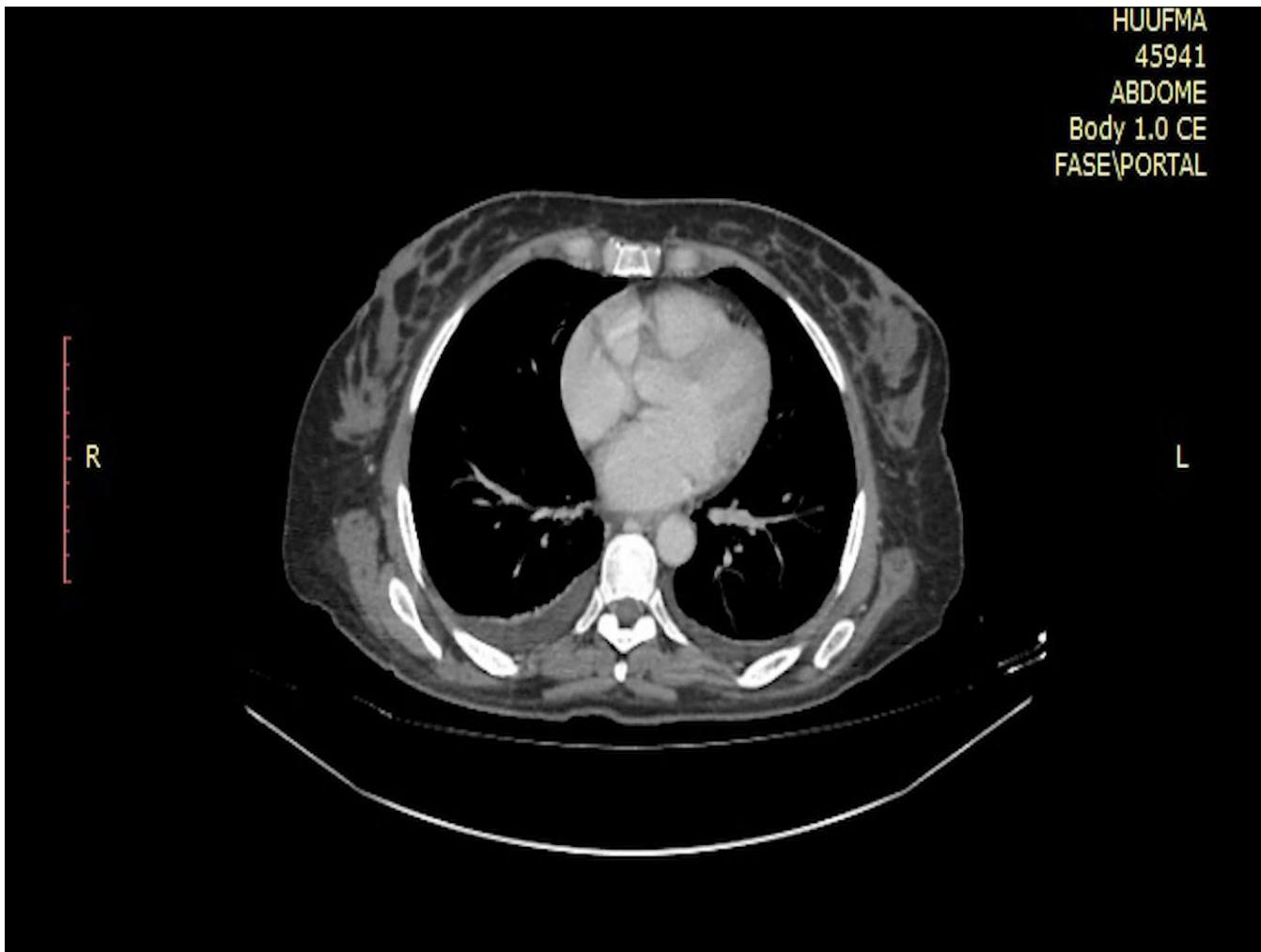
Tumor in segment 4

Transection line



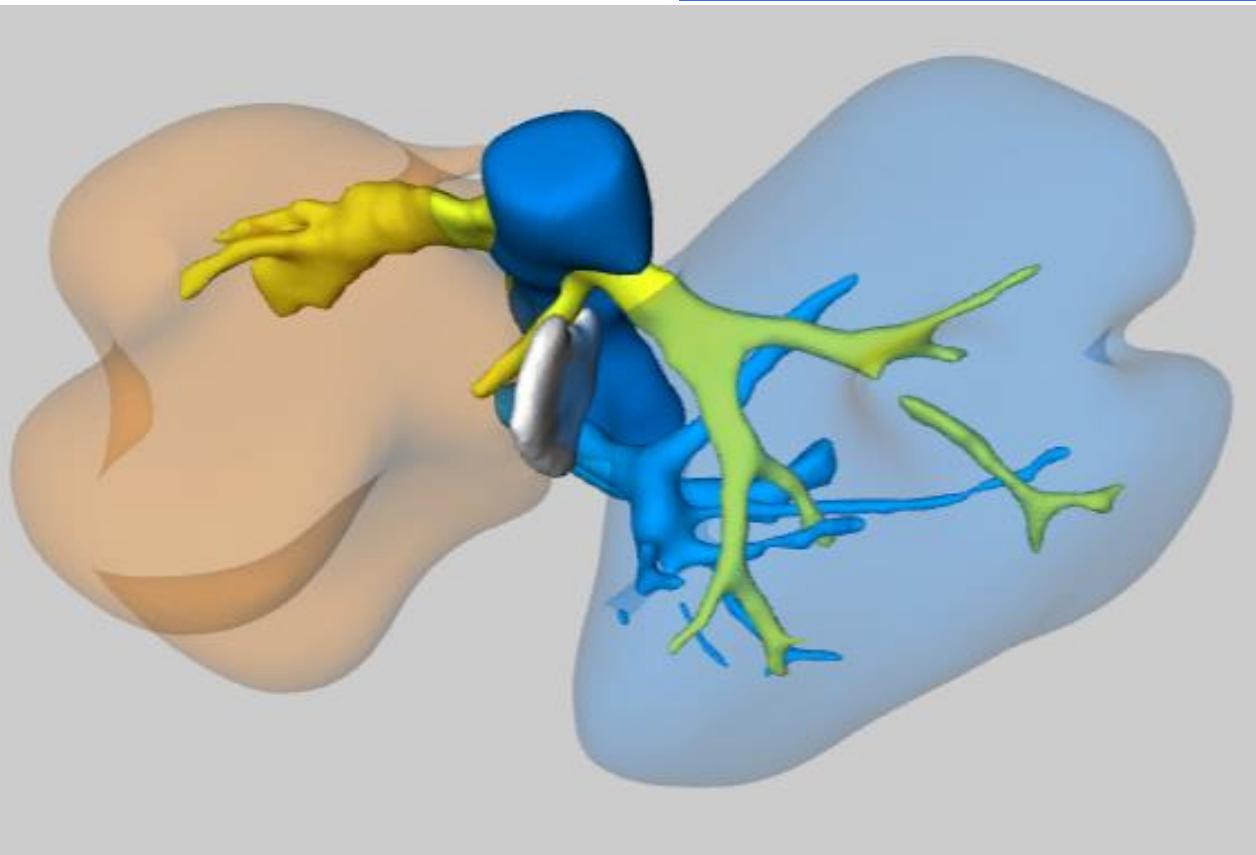
CT scan

- After 6 days
- Portal phase



VOLUMETRY

Liver 915.8 ml
 FLR 477.8 ml



Segments 2/3

FLR 52.2%



Name

Gender, Age

Date

Liver View

Serie/s View

Liver :915.8 ml

Cut Liver :434.8 ml / %47.5

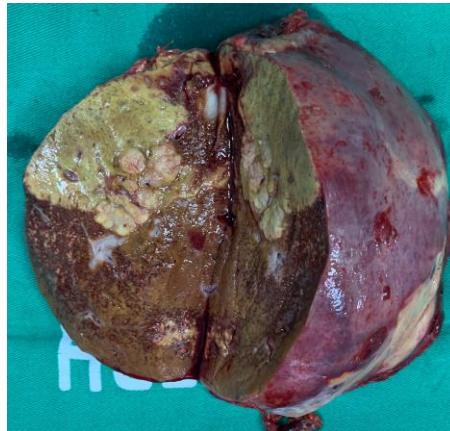
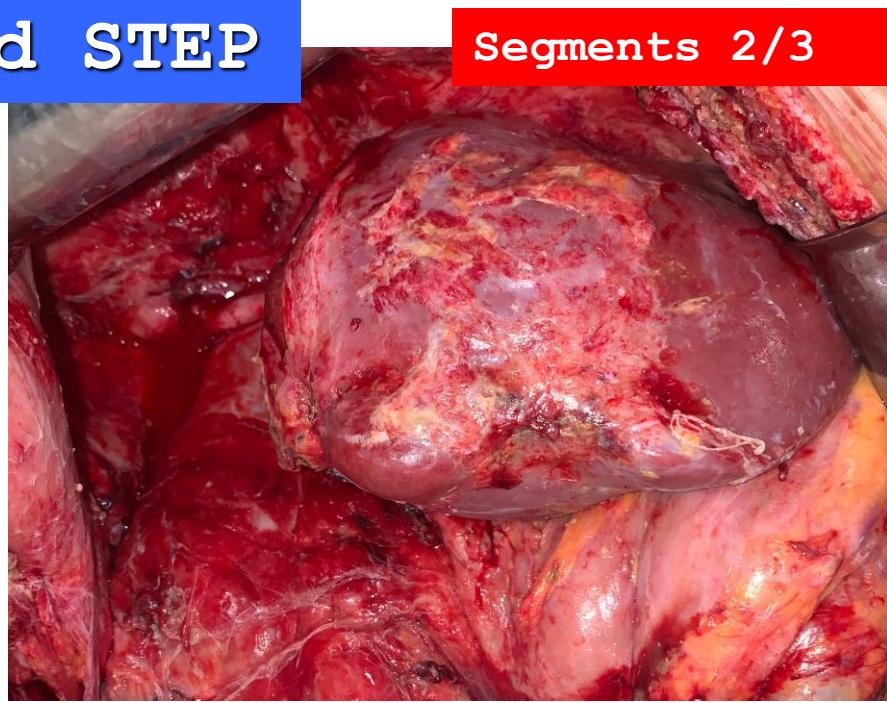
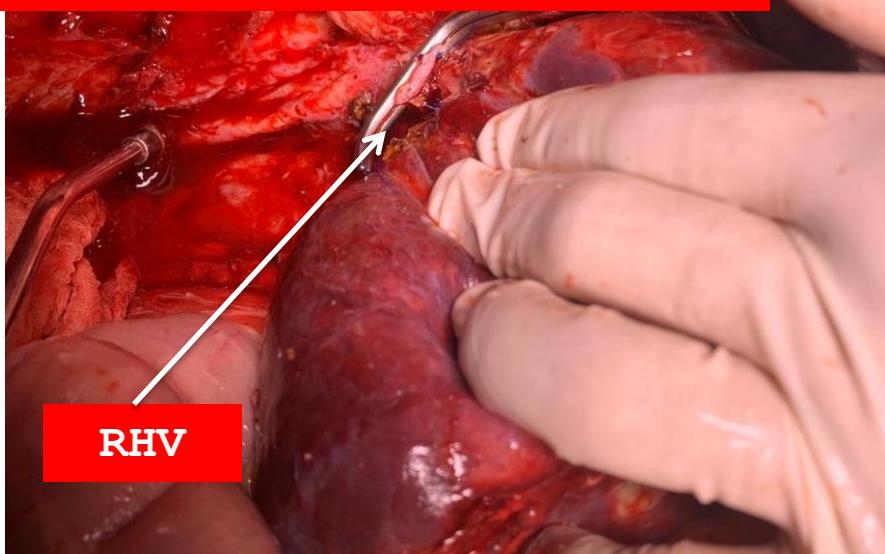
FLR :477.8 ml / %52.2

Courtesy: Prof. Deniz Balci (Ankara - Turkey)

ALPPS 2nd STEP

Segments 2/3

7 days after step 1



SPECIMEN



POSTOPERATIVE COURSE

- ICU 3 days
- No complications \geq 3b (clavien-dindo)
- Length of stay 12 days

CHEMOTHERAPY

CASE 2

ALPPS MONOSEGMENT FOR COLORECTAL LIVER METASTASIS



Thanks!

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