

# 1 st International Consensus Meeting on ALPPS

February 27<sup>th</sup> and 28<sup>th</sup> 2015, Hamburg, Germany

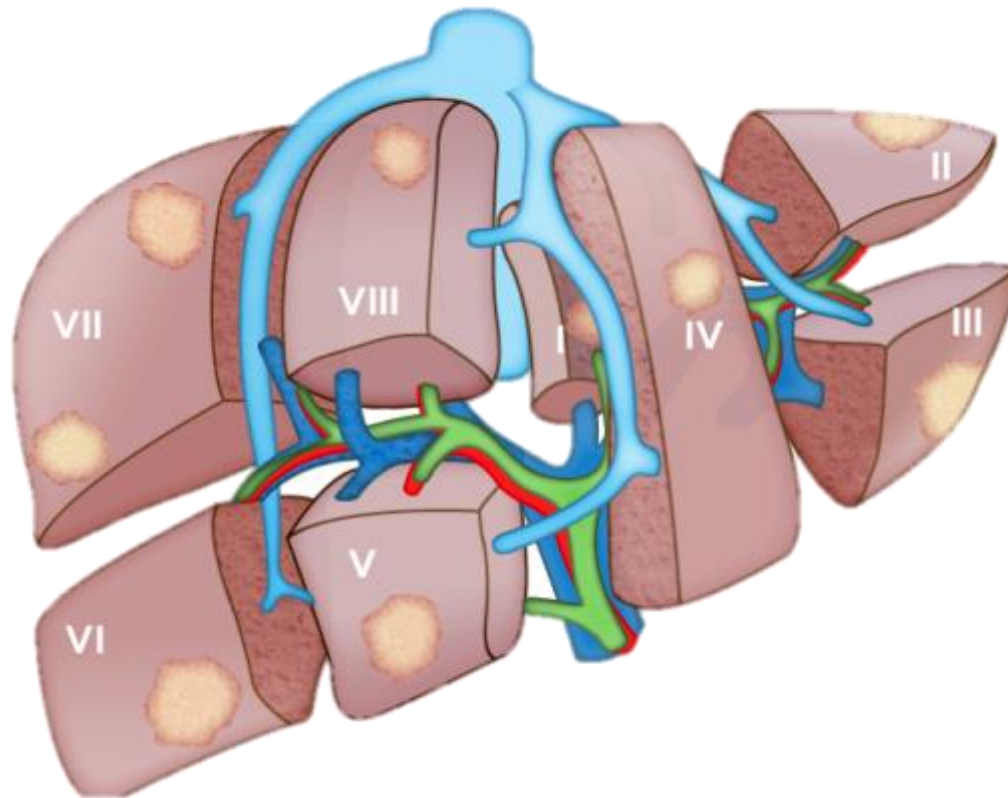
## ❑ Technical aspects of ALPPS Group

- ❑ S Govil (Bangalore, India)
- ❑ M Enne (Rio de Janeiro, Brasil)
- ❑ P Herman (Sao Paolo, Brasil)
- ❑ R Hernandez-Alejandro (Ontario, Canada)
- ❑ Silvio Nadalin (Tuebingen, Germany)
- ❑ O Torres (Sao Luiz, Brasil)

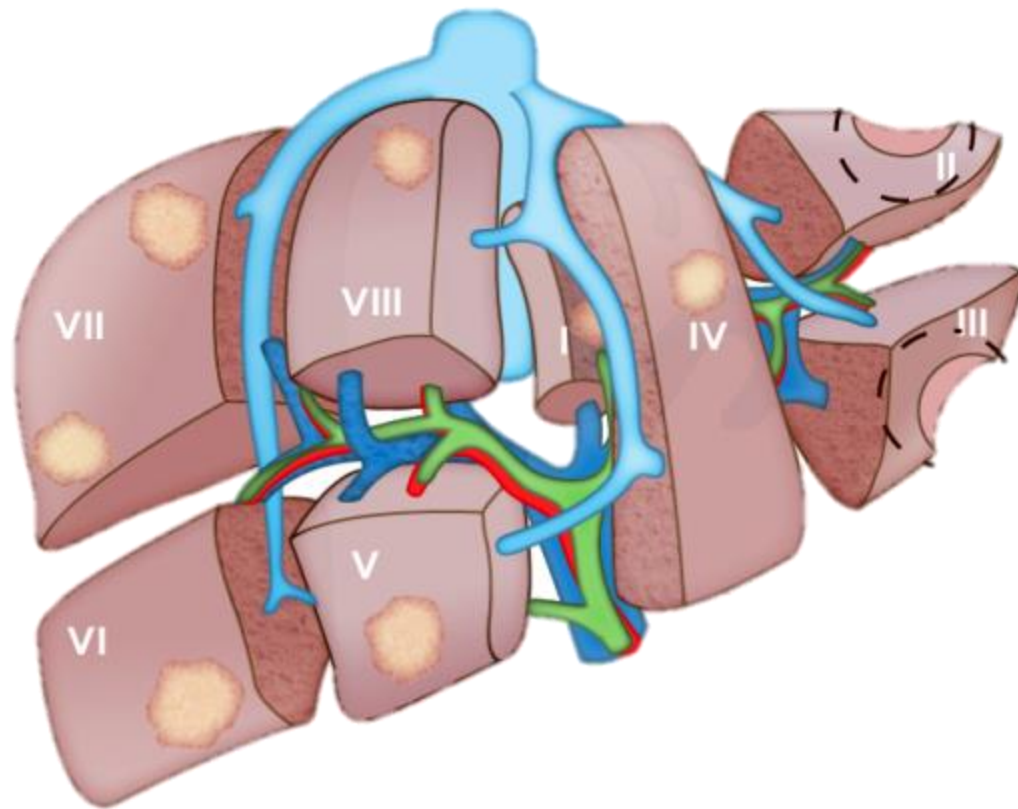


Hans Jurgen Schlitt  
Regensburg University  
Germany - 2007

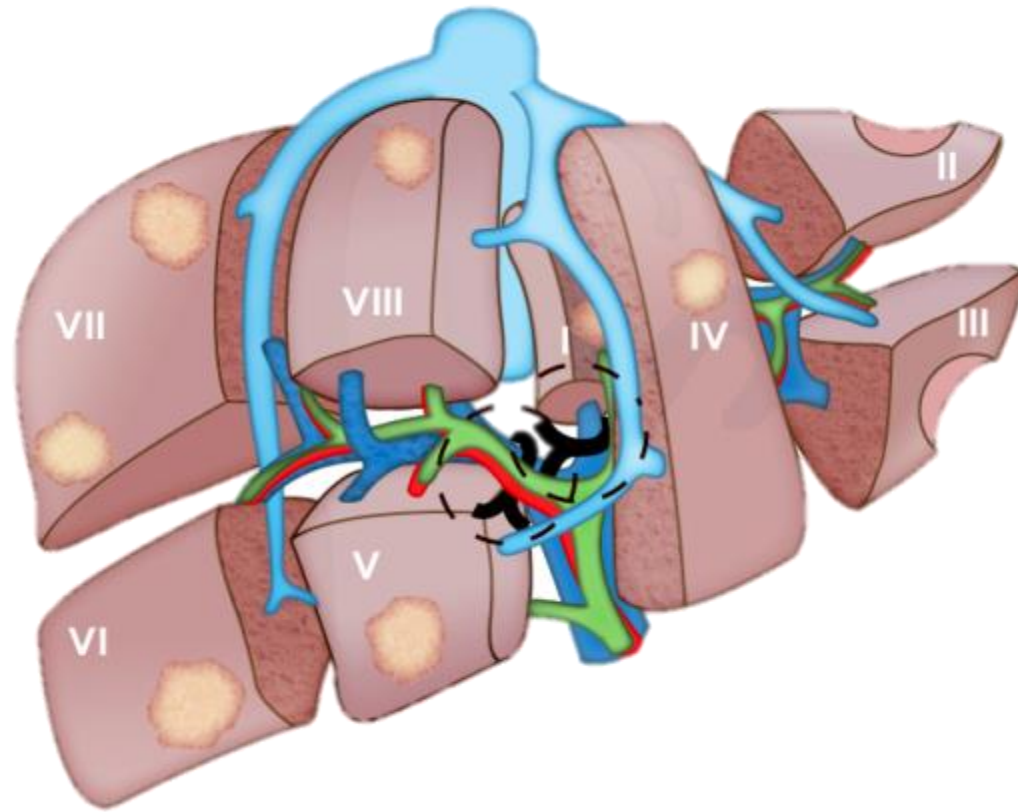
# ALPPS



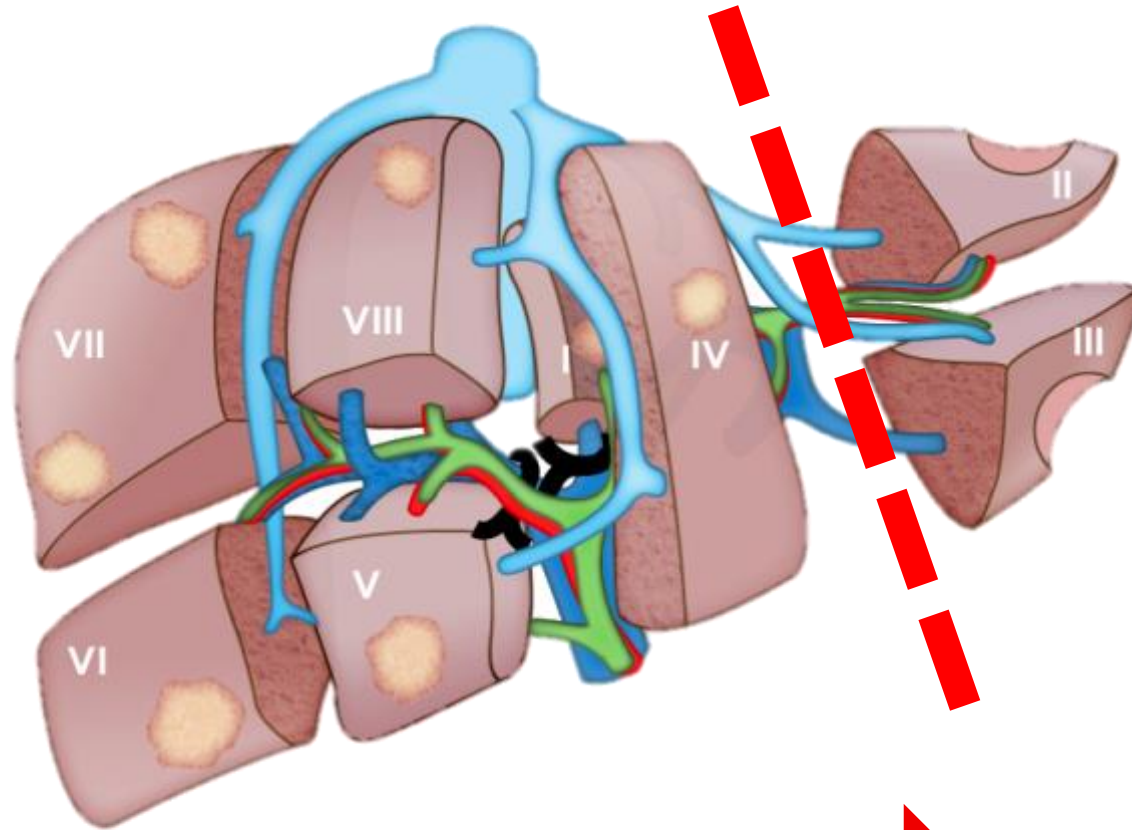
# ALPPS



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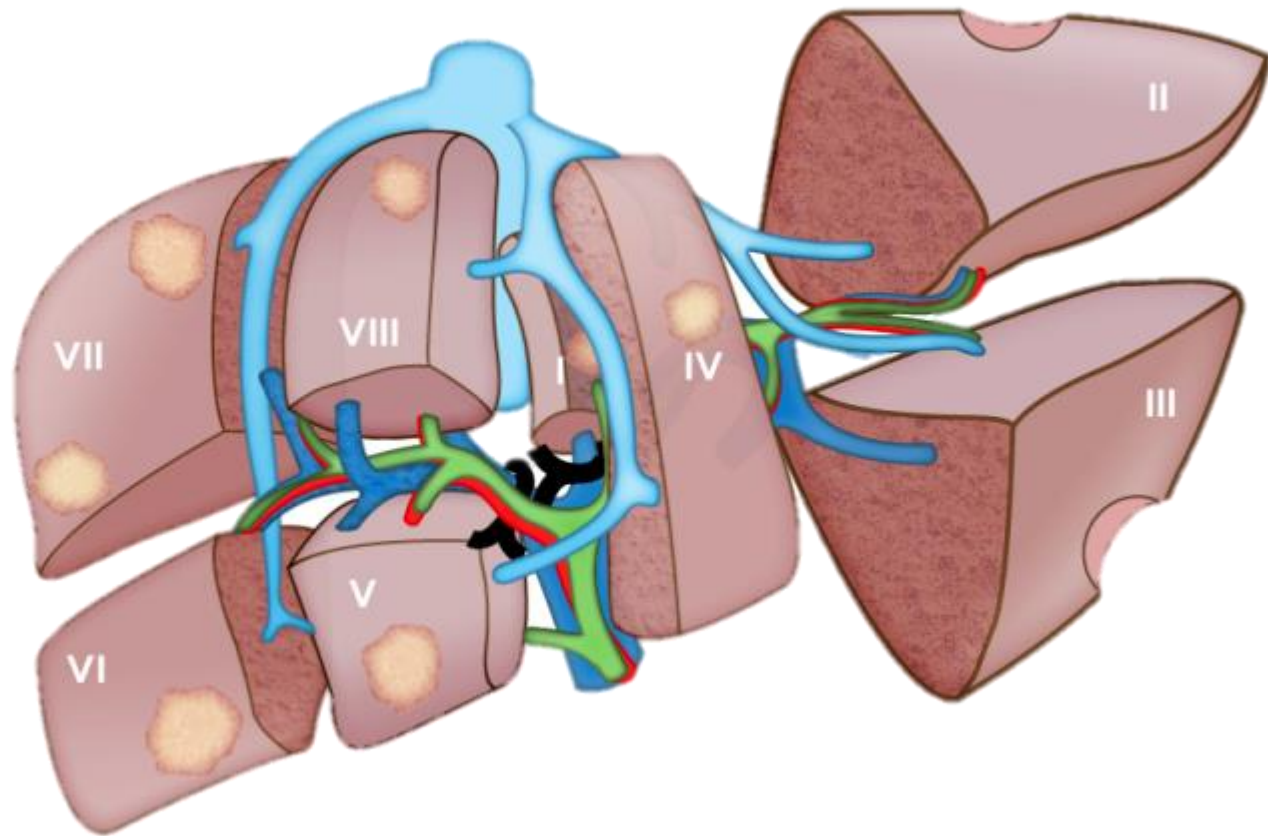
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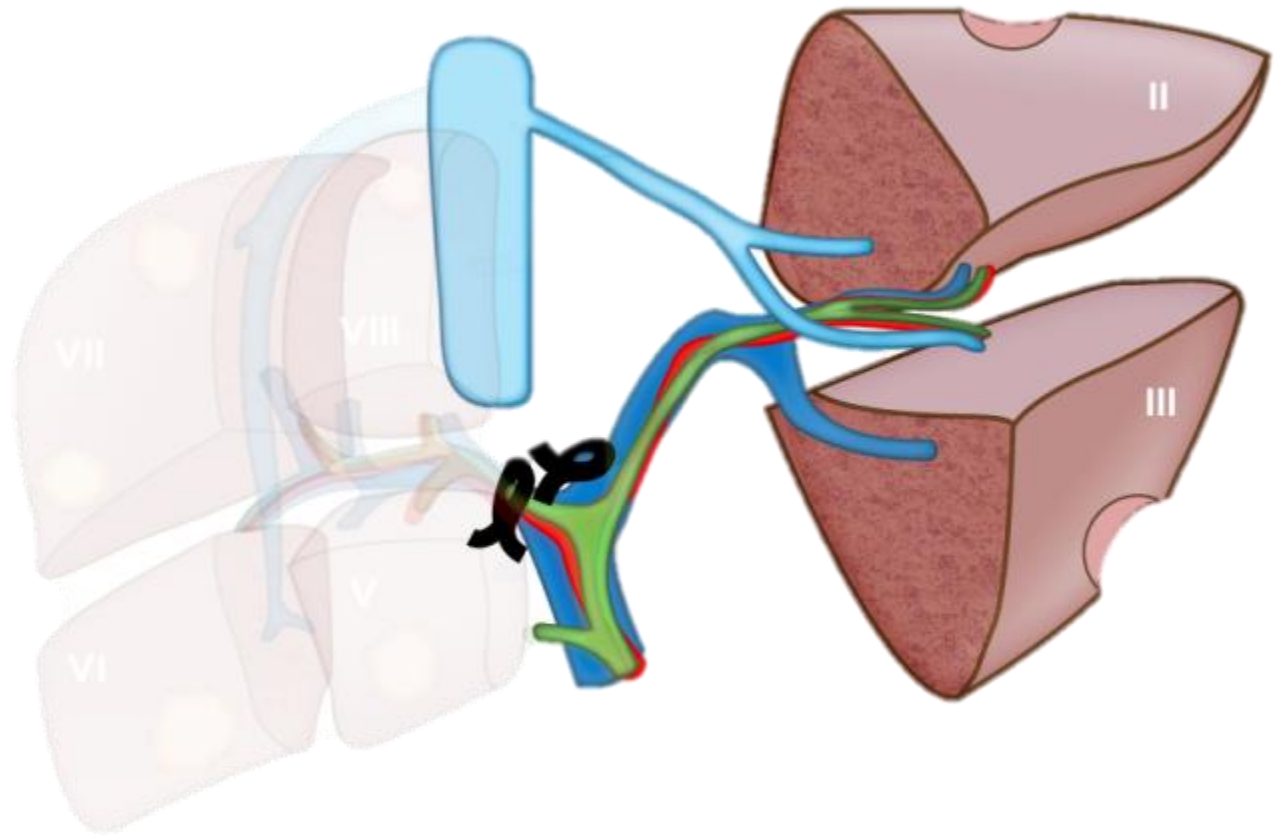
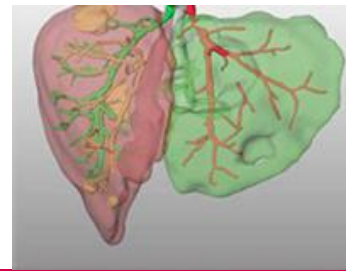
7 days



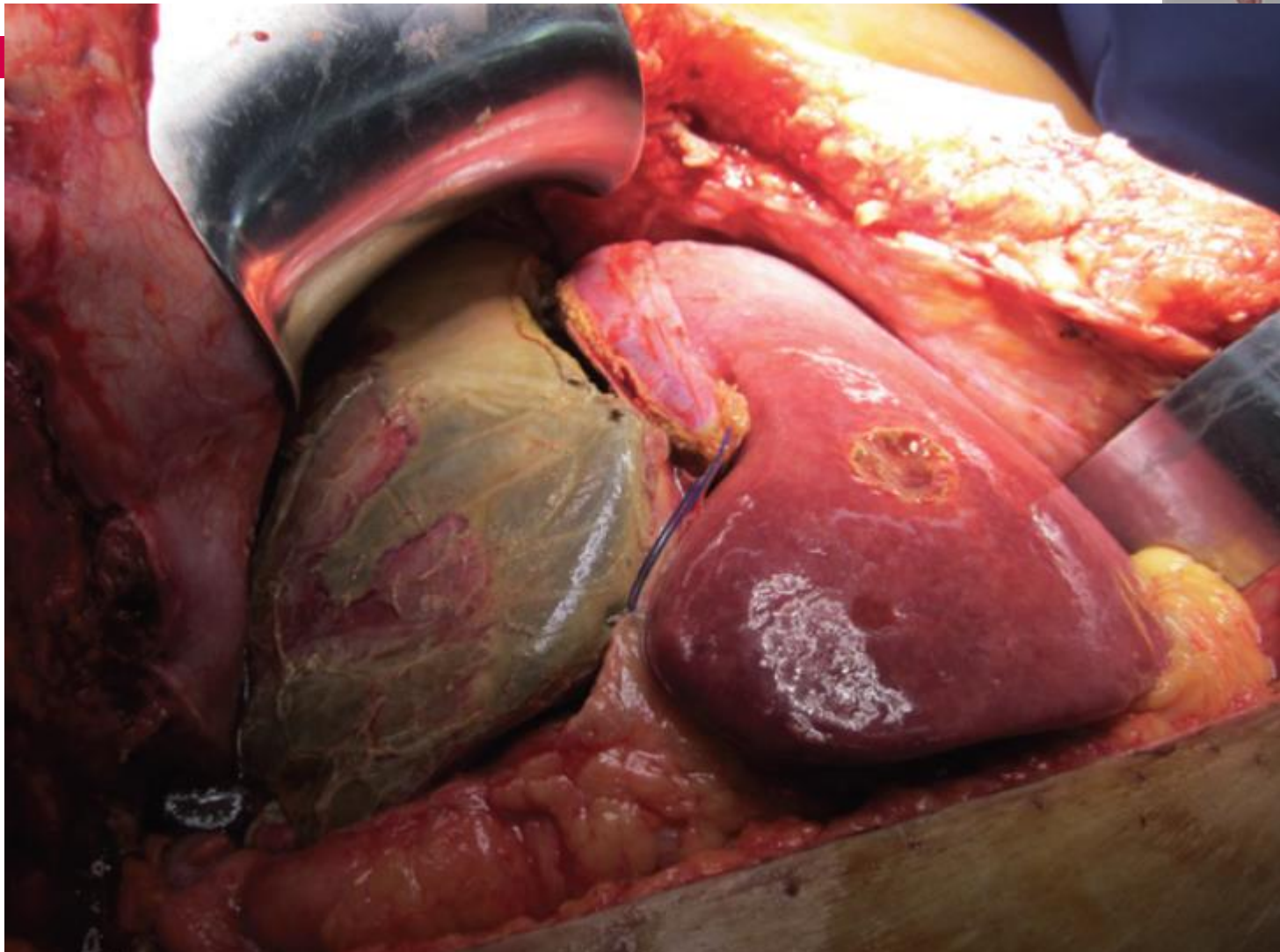
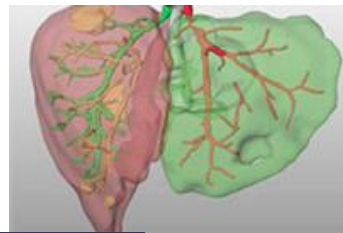
# ALPPS



# ALPPS









PAPER OF THE 21ST ANNUAL ESA MEETING

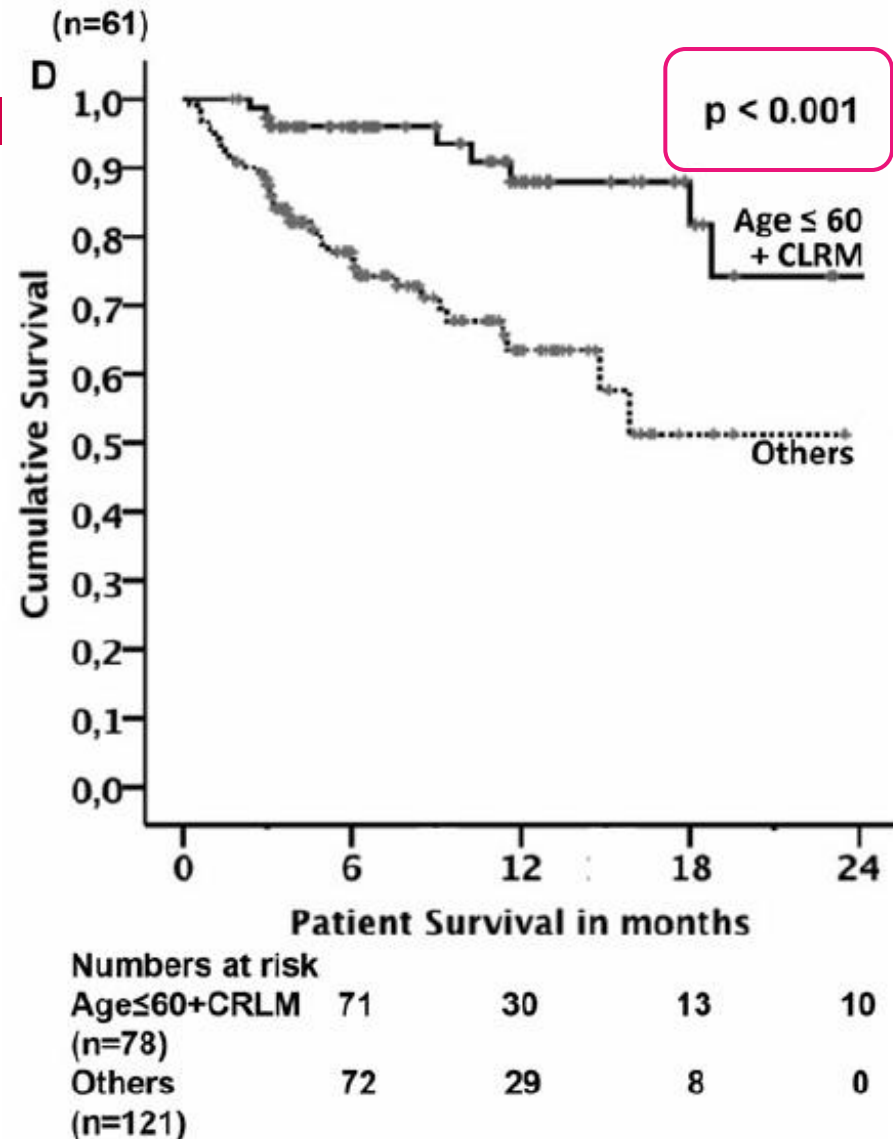
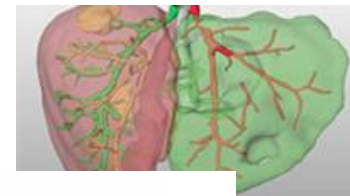
## Early Survival and Safety of ALPPS

### *First Report of the International ALPPS Registry*

*Erik Schadde, MD, FACS,\* Victoria Ardiles, MD,† Ricardo Robles-Campos, MD,‡ Massimo Malago, MD, FACS,§  
Marcel Machado, MD,¶ Roberto Hernandez-Alejandro, MD,|| Olivier Soubrane, MD,\*\*  
Andreas A. Schnitzbauer, MD,†† Dimitri Raptis, MD,\* Christoph Tschuor, MD,\* Henrik Petrowsky, MD, FACS,\*  
Eduardo De Santibanes, MD, PhD, FACS,† and Pierre-Alain Clavien, MD, PhD, FACS\*§§; On behalf of the ALPPS  
Registry Group*

40 % Morbidity  
9 % Mortality

# ALPPS Registry





# Can we improve the morbidity and mortality associated with the associating liver partition with portal vein ligation for staged hepatectomy (ALPPS) procedure in the management of colorectal liver metastases?

Roberto Hernandez-Alejandro, MD,<sup>a</sup> Kimberly A. Bertens, MD, MPH,<sup>a</sup> Karen Pineda-Solis, MD,<sup>a</sup> and Kristopher P. Croome, MD, MS,<sup>a,b</sup> *London, Ontario, Canada, and Rochester, MN*

36 % Morbidity  
0 % Mortality

# Anatomical aspects of ALPPS

X Rogiers (Ghent, Belgium)

A Schnitzbauer (Frankfurt, Germany)

V Lyadov (Moscow, Russia)



## Technical aspects of ALPPS

S Govil (Bangalore, India)

M Enne (Ipanema, Brasil)

P Herman (Sao Paolo, Brasil)

R Hernandez-Alejandro (London, Ontario, Canada)

S Nadalin (Tuebingen, Germany)

O Torres (Sao Luiz, Brasil)

# Topics



- ❑ Hepatoduodenal ligament - approach
  - ❑ Skeletonize
  - ❑ Lymphadenectomy
- ❑ Management of Outflow in deportalized liver
- ❑ Pringle maneuver
- ❑ Parenchymal transection (Partition)
- ❑ Management of bile duct
- ❑ Barriers, IOUS and energy devices



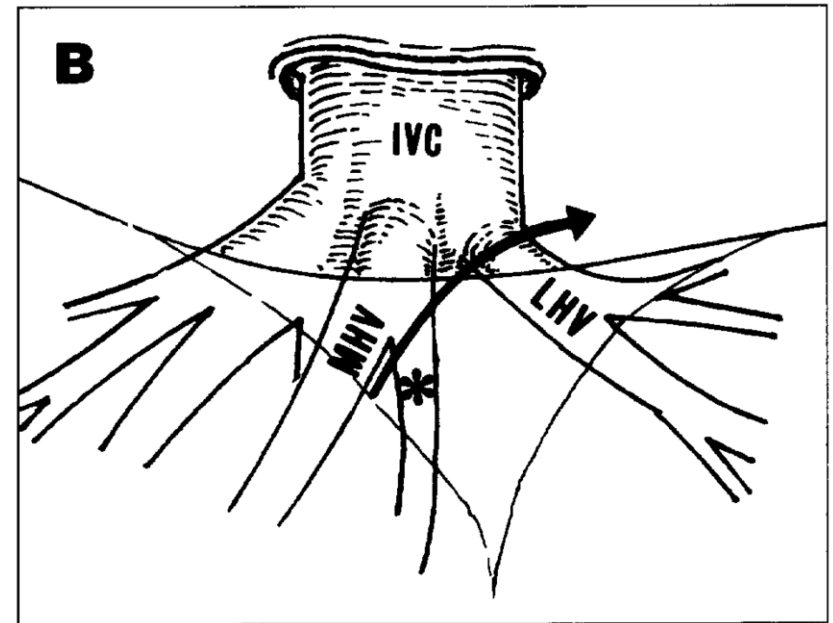
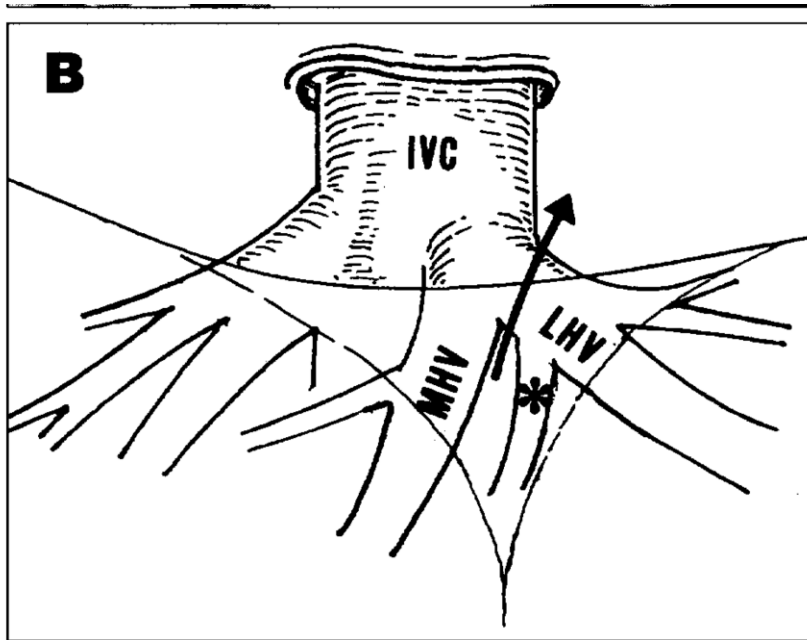


- ❑ Preserve the middle hepatic artery (segment IV)
- ❑ Preserve the middle hepatic vein
- ❑ Avoid ligate the bile duct during the first step
- ❑ Careful evaluation of bile leak
- ❑ Plastic bag – no evidence

#### Answered questions

- ❑ Vascular occlusion – no recommendation
- ❑ Pringle – no recommendation
- ❑ Partial ALPPS – no recommendation
- ❑ Lymphadenectomy

# Middle hepatic vein



- Ligate during the first step?
- Image:
  - 3D CT or trifasic
  - IOUS

# Outflow of the deportalized liver



- ❑ Classic ALPPS – Ligature of MHV
- ❑ MHV drain segments 4, 5 and 8 (Congestion)

*Hwang et al. Ann Surg 2009;249(4)*

- ❑ Deportalized liver + congestion:
  - ❑ Ischemia
  - ❑ Bile leak
  - ❑ Sepsis



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# MHV preserved



Author	n	Complications	Severe Complications	Mortality	Volume Gain
Petrowsky 2015	6	2	2	0	61%
Alvarez 2015	21	8	NS	NS	89.7%
Hernandez-Alejandro 2015	14	5	2	0	93%
Chan 2014	1	0	0	0	46.1%
Fukami 2014	1	0	0	0	49.8%
Bjornsson 2013	2	0	0	0	106%
Cavaness 2012	1	0	0	0	100%
<b>Total</b>	<b>46</b>	<b>13</b>	<b>4</b>	<b>0</b>	

# MHV divided



Author	n	Complications	Severe Complications	Mortality	Volume Gain
Petrowsky 2015	18	12	12	4	60%
Alvarez 2015	9	8	NS	NS	89.7%
Jackson 2014	1	0	0	0	NS
Nadalin 2014	15	11	10	4	61%
Chan 2014	1	0	0	0	26%
Robles 2014	22	14	NS	2	70.7%
Machado 2013	1	0	0	0	60%
Torres 2013	39	NS	23	5	83%
Govil 2012	1	1	1	0	60%
<b>Total</b>	<b>107</b>	<b>46</b>	<b>46</b>	<b>15</b>	



# MHV divided: consequences



	MHV Preserved	MHV Divided	Total	p value
Complications	13/46 (28.6%)	46/68 (68%)	59	0.000
Severe Complications	4/25 (16%)	46/76 (60.5%)	55	0.000
Mortality	0%	15/98 (15.3%)		0.03

# Management of the bile duct



## Bile duct ligation in deportalized liver

- Induce atrophy of the deportalized liver and hypertrophy of the FLR.

*Dokmak , Ann Surg, 2012*

- Hypertrophy after 7 days - similar
- 87.5% de bile leak and/or biloma at the cut surface.
- Conclusions: Do not ligate the bile duct routinely.



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# Biliary complications/fistula



- ALPPS: Impact of the inter-stages course on morbi-mortality and implications for management

*Truant, Adam, Pruvot et.al. EJSO 2015 e-pub*
- n=62 patients
- Factors associated with major morbi-mortality
  - Post stage biliary fistula
  - Infected and/or bilious peritoneal fluid at stage 2 (*only predictor on multivariate analysis*)

# Any Benefit of Cholangiography?



- ALPPS literature and registry not enough data
- LDLT 90% of the cases reported have a cholangiography
  - LDLT donor surgery is similar to ALPPS
  - Reported a significant benefit in the donor and recipient

# Conclusions



- ❑ Level of evidence 4, 3b (multicenter with multivariate analyses)
- ❑ Bile leakage test is safe and reduce post-operative bile leakage
- ❑ No preference of bile leak test



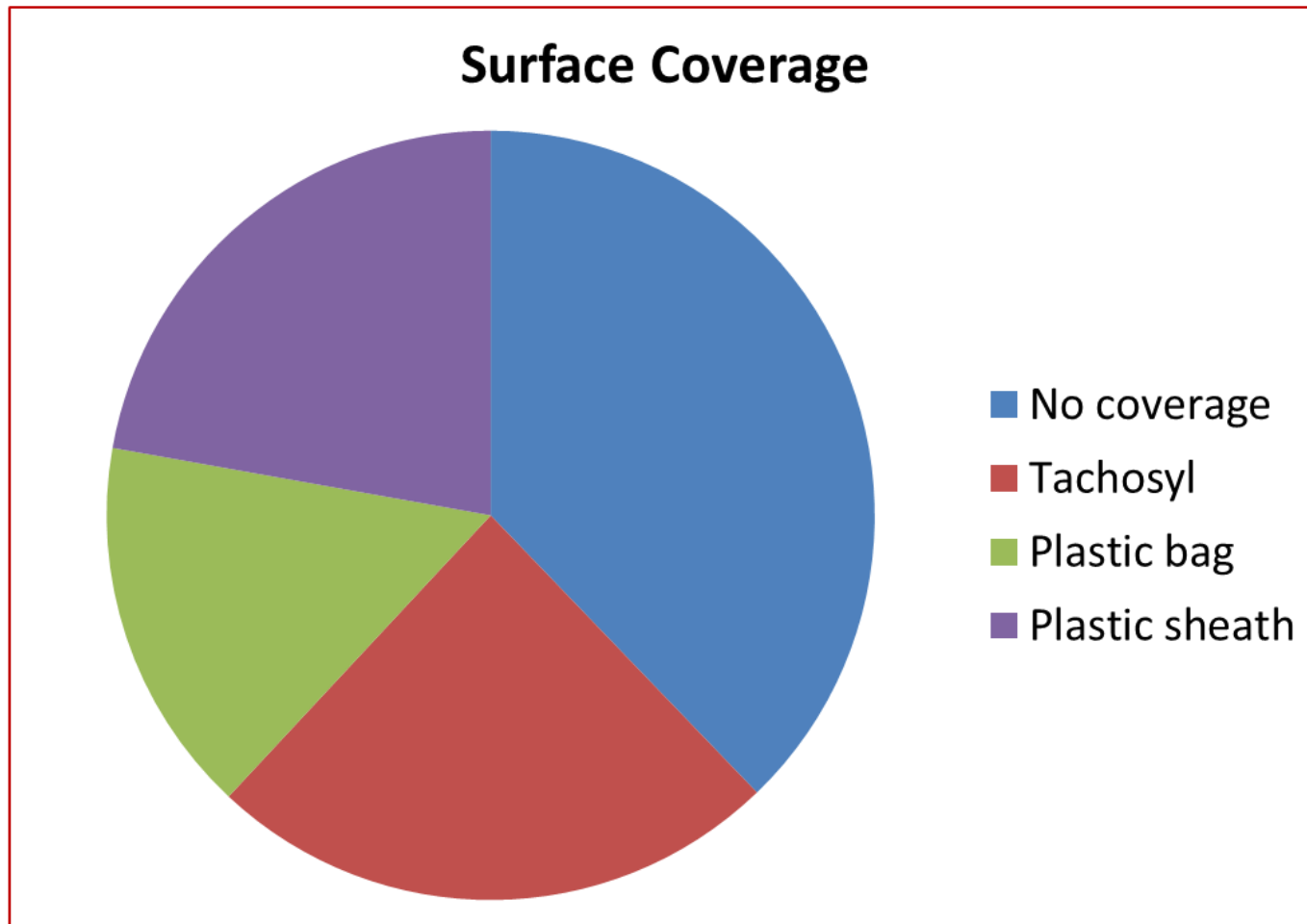


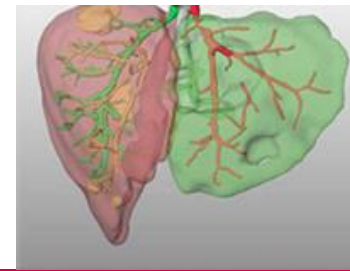
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# Surface coverage





	No Cover	Plastic Bag	Plastic Sheet	Tachosil
Complications Stage 1	6/93 (6.4%)	4/43 (9%)	8/68 (12%)	6/67 (8.9%)
Major Complications Stage 1	3 (50%)	0	3 (37%)	2 (33%)
Complications Stage 2	52 (57%)	20 (45%)	44 (64%)	37 (57%)
Major Complications Stage 2	28 (54%)	8 (40%)	24 (54%)	22 (59%)



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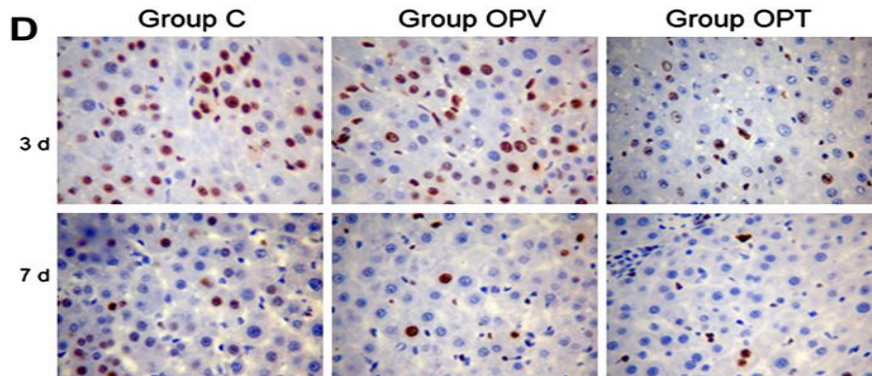
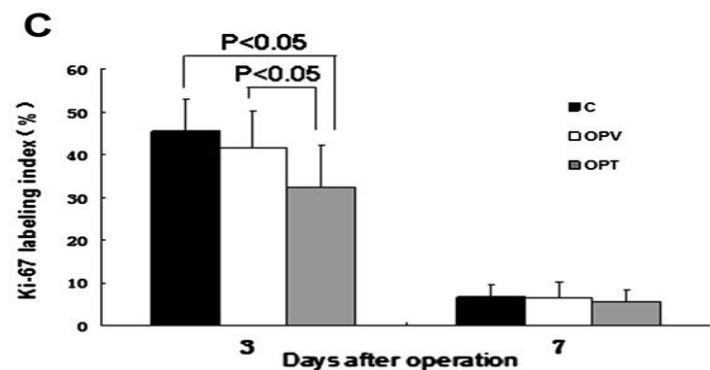
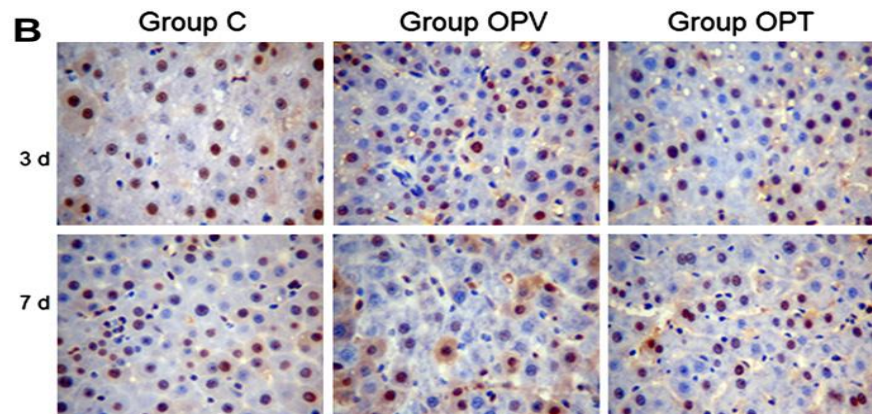
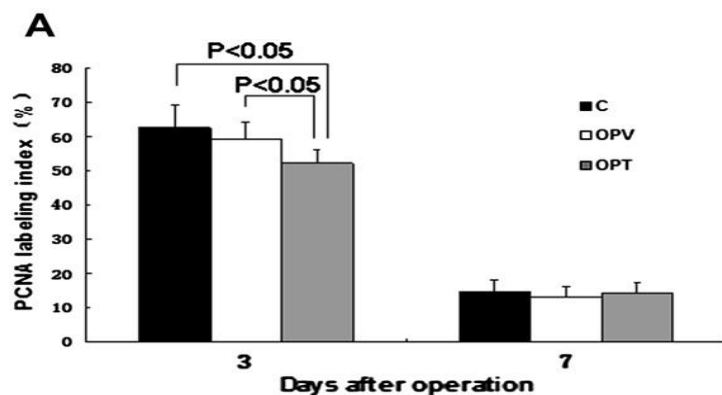
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# Preserving hepatic artery flow during portal triad blood inflow occlusion improves remnant liver regeneration in rats after partial hepatectomy

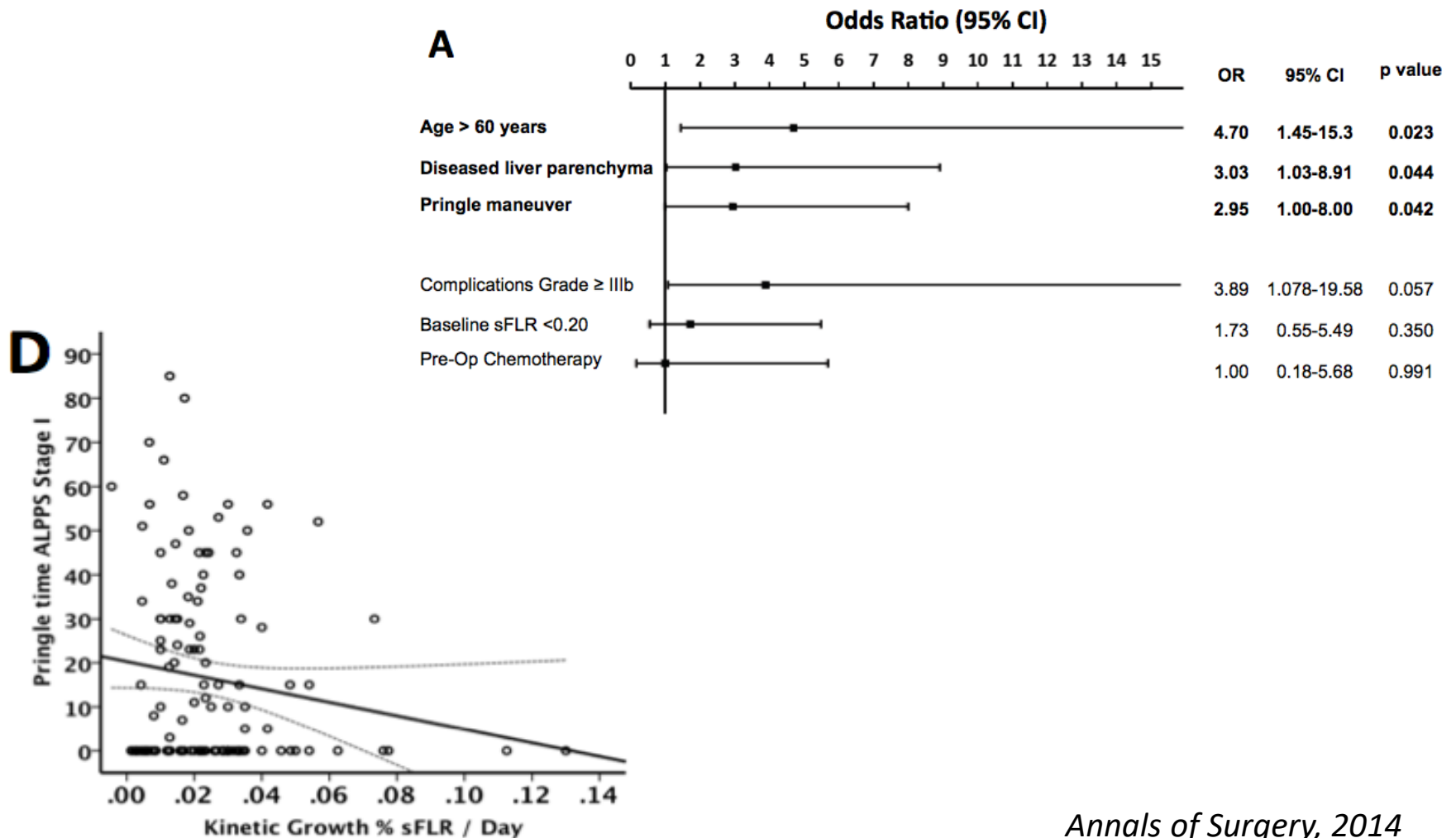


Peng Fei Wang, MD,<sup>a,1</sup> Chong Hui Li, PhD,<sup>b,1</sup> Yong Wei Chen, MD, PhD,<sup>a</sup>  
Ai Qun Zhang, PhD,<sup>b</sup> Shou Wang Cai, MD, PhD,<sup>a</sup> and Jia Hong Dong, MD, PhD, FACS<sup>a,\*</sup>



# Logistic Regression Analysis for $KG < 0.022/\text{Day}$

## Univariate Correlation Between KG and Pringle





# Influence of Pringle Maneuver During Stage 1 ALPPS on Complications after Stage 1



	<b>Pringle n = 121</b>	<b>No Pringle n = 116</b>	<b>Total n = 237</b>	<b>P value</b>
Complications	55 (45%)	25 (21%)	80	0.001
Biliary Complications	12 (22%)	2 (8%)	14	0.2

# Influence of Pringle Maneuver During Stage 1 ALPPS on Complications after Stage 2



	<b>Pringle n = 117</b>	<b>No Pringle n = 107</b>	<b>Total n = 224</b>	<b>P value</b>
Complications	80 (68%)	52 (48%)	132	0.002
Liver Failure	13 (16%)	3 (6%)	16	0.1



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- ❑ Partial ALPPS – no recommendation
- ❑ Lymphadenectomy



## Is Partial-ALPPS Safer Than ALPPS?

### *A Single-Center Experience*

*Henrik Petrowsky, MD, FACS,\* Georg Györi, MD,\* Michelle de Oliveira, MD, FACS,\* Mickaël Lesurtel, MD, PhD,\*  
and Pierre-Alain Clavien, MD, PhD, FACS†*

- 50- 80% transection
- Hepatic veins level
- Anterior approach
- For tumor located:
  - At the hilum
  - Near the transection line

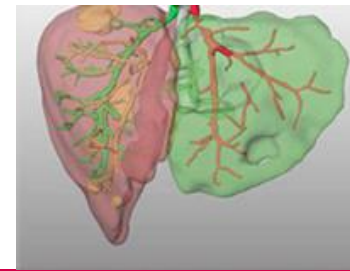


## Is Partial-ALPPS Safer Than ALPPS?

*A Single-Center Experience*

- ❑ 6 p-ALPPS vs 18 ALPPS
- ❑ p-ALPPS: 3 right hepatectomy

	p-ALPPS	ALPPS
Hypertrophy	60 %	61%
Severe complications	0 %	33 %
Mortality	0 %	22 %



# Associating Liver Partition and Portal Vein Ligation for Staged Hepatectomy Offers High Oncological Feasibility With Adequate Patient Safety

## *A Prospective Study at a Single Center*

*Fernando A. Alvarez, MD, Victoria Ardiles, MD, Martin de Santibañes, MD, Juan Pekolj, MD, PhD,  
and Eduardo de Santibañes, MD, PhD*

- Prospective study - single center
- 21 p-ALPPS vs 9 ALPPS
- Transection during p-ALPPS %?

	<b>p-ALPPS</b>	<b>ALPPS</b>	<b>p</b>	<b>Total</b>
Hypertrophy	90 %	107 %	0.45	
Severe complications	ND	ND		31 %
Mortality	ND	ND		6,6 %

# Conclusions



- ❑ No literature data for complications after stage I.
- ❑ Faster?
- ❑ Complexity of stage II?
- ❑ Similar regeneration?
- ❑ p-ALPPS is feasible but more data are necessary
- ❑ Level of evidence 4



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# Lymphadenectomy “Yes”



Author	Journal	Patients	Complications
Schnitzbauer et al	<i>Ann Surg</i> 2012	25	50 (25 % Severe)
Santibanes et al	<i>Cir Esp</i> 2011	1 (Case Report)	0
Santibanes et al	<i>Updates Surg</i> 2012	10	2 (Biliary Leakage)
Santibanes et al	<i>Ann Surg</i> 2014	30	31% Severe 4 Biliary Leakage 6.6% Mortality
<b>“No more data in literature about routine lymphadenectomy”</b>			

# Lymphadenectomy “No”



- 15 patients, severe complications 16% and 0 mortality

*Hernandez-Alejandro et al Surgery 2015*

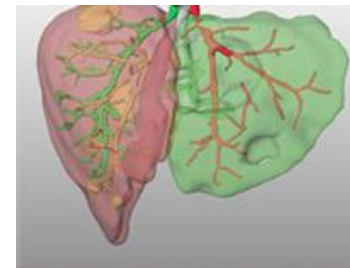
- 24 cases (Feb 2015)
  - Major morbidity 22%
  - Severe morbidity 12.5%
  - 90 day mortality 0%

# Lymphadenectomy and morbidity



<b>n=264</b>	<b>Lymphadenectomy n=82</b>	<b>No Lymphadenectomy n=182</b>	<b>p value</b>
Complications	34 (41%)	49 (27%)	0.018
Severe Complications	NA	NA	
Biliary Complications	20%	16%	
Infection/Sepsis	15%	12%	

# Lymphadenectomy and morbidity



<b>n=254</b>	<b>Lymphadenectomy n=82</b>	<b>No Lymphadenectomy n=172</b>	<b>p Value</b>
Complications	47 (57%)	97 (56%)	0.89

<b>n=144</b>	<b>Lymphadenectomy n=47</b>	<b>No Lymphadenectomy n=97</b>	<b>P Value</b>
Severe Complications	24 (51%)	26 (27%)	0.004

- Biliary complications 20% in both groups
- Infection/sepsis 25% in + lymph vs 8%



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### Answered questions

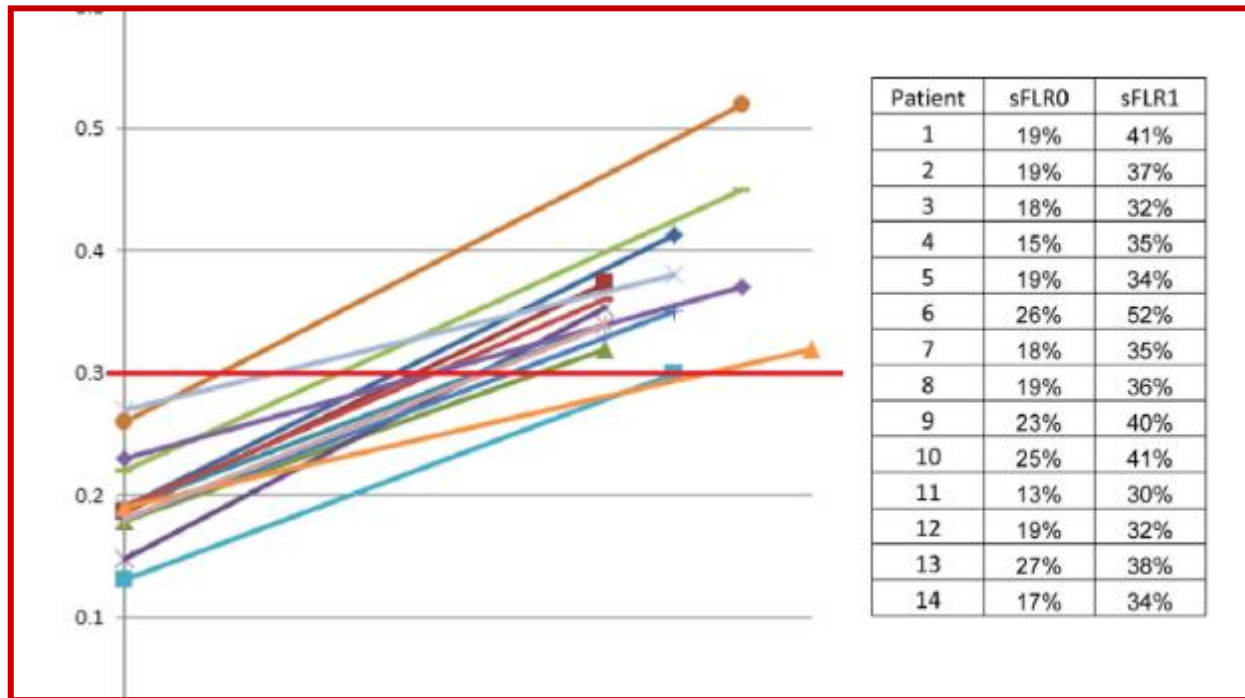
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# Timing (Interval between Stage 1 and 2)



- ALPPS Registry (2015)
  - ❑ Mean = 13.7 days (6-64)
  - ❑ Median = 8 days
- Alvarez et al. Ann Surg 2014
  - ❑ 24/29 (80% efficacy – hypertrophy-10 days)
  - ❑ Mean of hypertrophy = 89.7%
- Torres et al. Arq Bras Cir Dig. 2013
  - ❑ 39 patients (multicentric):14.1 days (6-30)

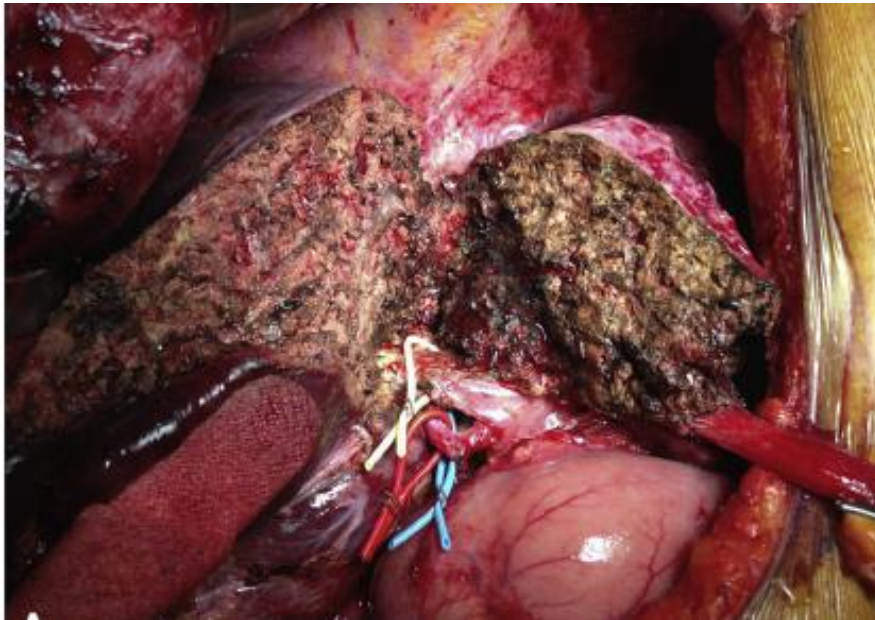
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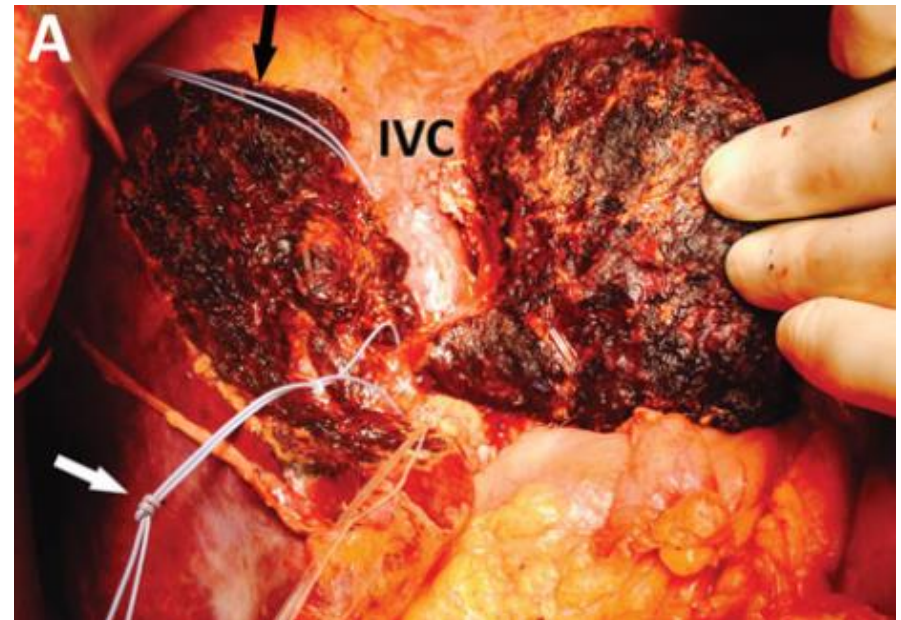
7-9 days  
Median increase =  $93 \pm 28\%$

## Vessel Identification Tags for Open or Laparoscopic Associating Liver Partition and Portal Vein Ligation for Staged Hepatectomy

Raffaele Brustia, MD, Olivier Scatton, MD, PhD, Fabiano Perdigao, MD, Sanaa El-Mouhadi, MD, François Cauchy, MD, Olivier Soubrane, MD



Brustia et al, *J Am Coll Surg* 2013



Alvarez et al, *Ann Surg* 2014

**Valuable, rapid and no related morbidity**





□ Thank you !