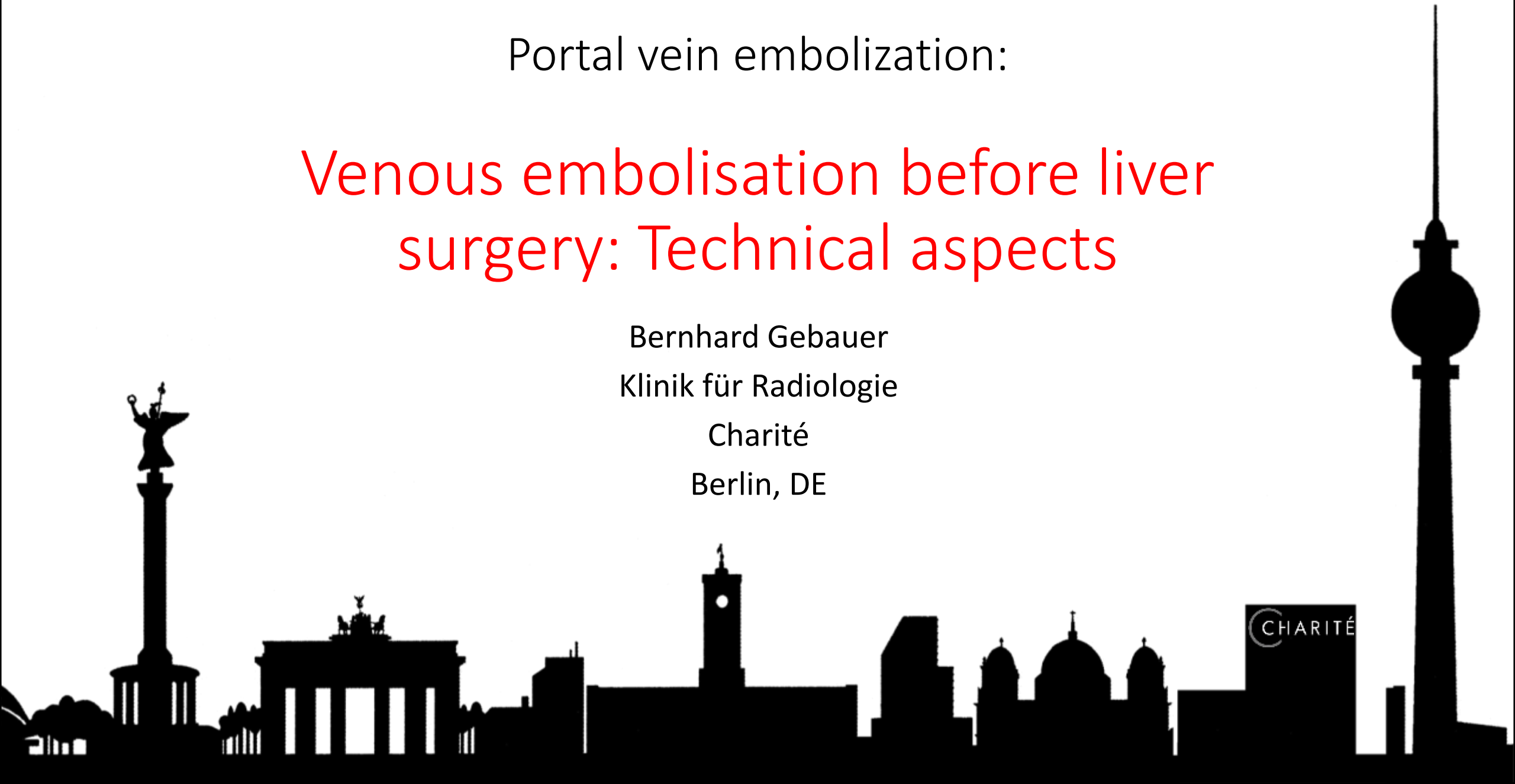


Portal vein embolization:

Venous embolisation before liver surgery: Technical aspects

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Financial disclosures

Study support, Proctoring, Travel support, Personals Fees

- Parexel
- C.R. BARD
- SIRTex Medical
- St. Jude Medical
- COOK
- AngioDynamics
- Pharmcept
- Guerbet
- Ewimed
- Roche
- Merck
- 3M
- Beacon Bioscience/ICON
- IPSEN
- Bayer
- Pfizer
- Elsay
- MSD

Learning objectives:

1. Access site
2. Segment 4
3. Embolization material
4. Endpoint

Access

Ipsilateral (right)

- no puncture of FLR or mets (compl. ↓)
- catheterisation of seg. 4 branches easier
- more difficult access site for glue
- completion angiography more difficult if glue, coils or plugs are used

Contralateral (left)

- physiologic puncture
- no puncture of tumor-bearing liver lobe
- good for glue embolization
- completion angiography easy
- higher risk of puncture related complications for FLR

Transileocolic

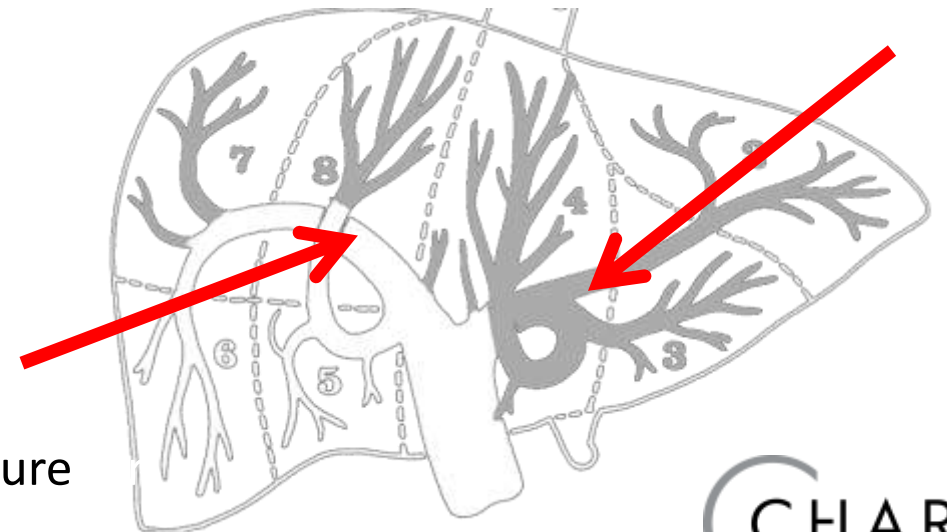
- intra-operative PVE

Transjugular-Transhepatic

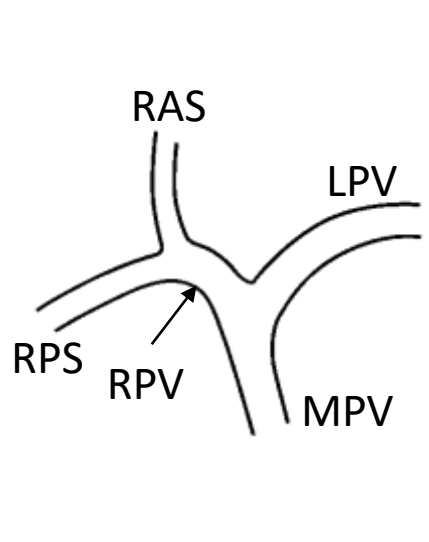
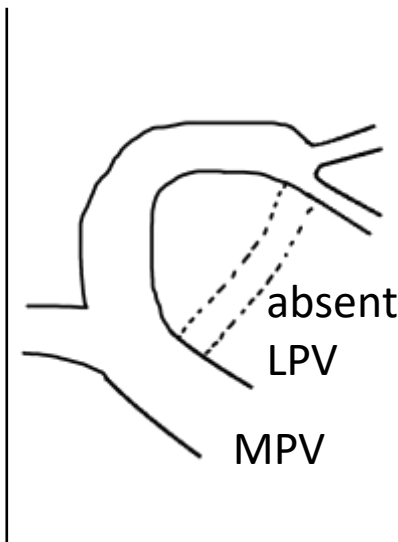
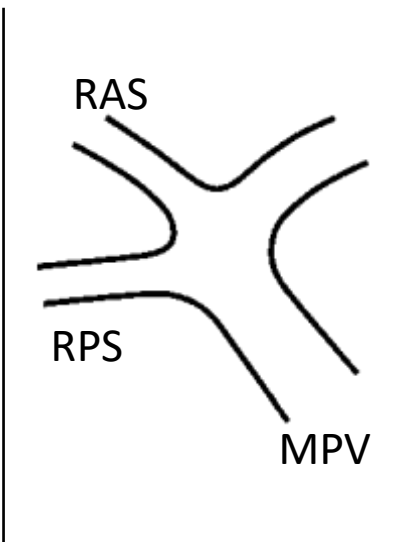
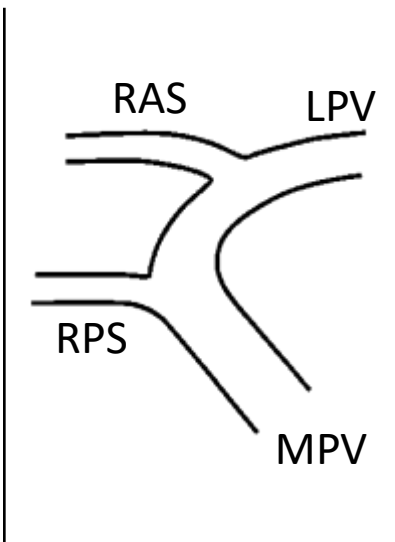
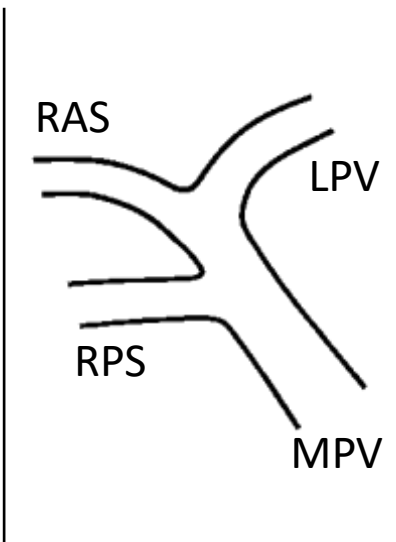
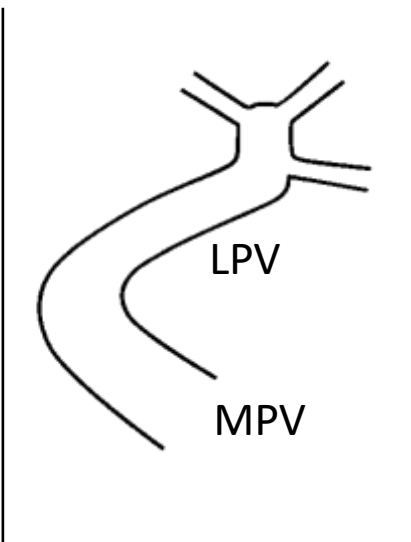
- PVE analogous to TIPS-Prozedur

Transsplenic

- PVE after percutaneous spleen puncture



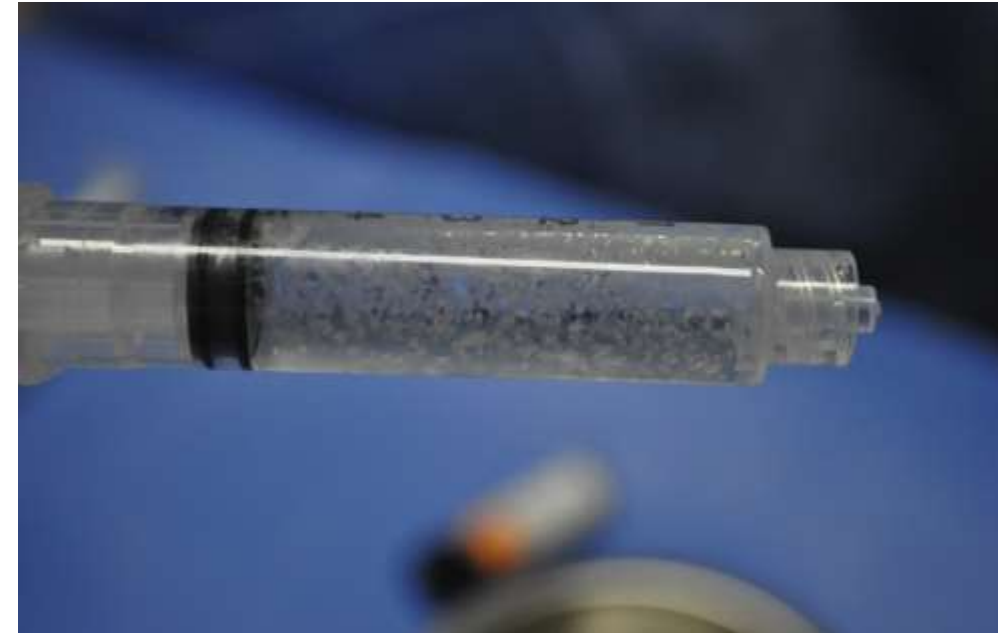
Portal Vein Variants

 <p>Diagram of normal portal vein anatomy. The main portal vein (MPV) bifurcates into the right portal vein (RPV) and the left portal vein (LPV). The RPV further divides into the right anterior segment (RAS) and the right posterior segment (RPS).</p>	 <p>Diagram of Type I variant. The LPV is absent. A branch from the RPV crosses the umbilical fissure to supply the left liver. The MPV bifurcates into RAS and RPS.</p>	 <p>Diagram of Type II variant. The RAS trifurcates into three branches: RAS, RPS, and LPV. The MPV bifurcates into RAS and RPS.</p>	 <p>Diagram of Type III variant. The RAS originates from the LPV. The MPV bifurcates into RAS and RPS.</p>	 <p>Diagram of Type IV variant. The RPS arises from the main portal vein (MPV) before it bifurcates into RAS and LPV.</p>	 <p>Diagram of Type V variant. The RPS and RAS are absent. The right liver is supplied by left portal branches. The MPV bifurcates into RAS and LPV.</p>
<p>normal</p>	<p>Type I</p>	<p>Type II</p>	<p>Type III</p>	<p>Type IV</p>	<p>Type V</p>
<p>Right and left portal vein (RPV, LPV), division of RPV in RAS and RPS</p>	<p>Absent LPV, branch from RPV crosses umbilical fissure and supplies left liver</p>	<p>Absent RPV, trifurcation in RAS, RPS and LPV</p>	<p>RAS (supplying seg. V & VIII) originates from LPV</p>	<p>RPS arises from main portal vein (MPV) before its bifurcation</p>	<p>Absent RPS, RPS and RAS. Right liver is supplied by left portal branches</p>

MPV: main portal vein; RPV: right portal vein; LPV: left portal vein; RPS: right posterior segment; RAS: right anterior segment

Embolisation material

- optimal agent:
 - permanent embolization
 - no recanalization
 - well tolerated
 - easy and safe to administer
 - price
- particles
- ethanol
- glue
- gelfoam
- fibrin glue



Embolisation material

FLR: future liver remnant

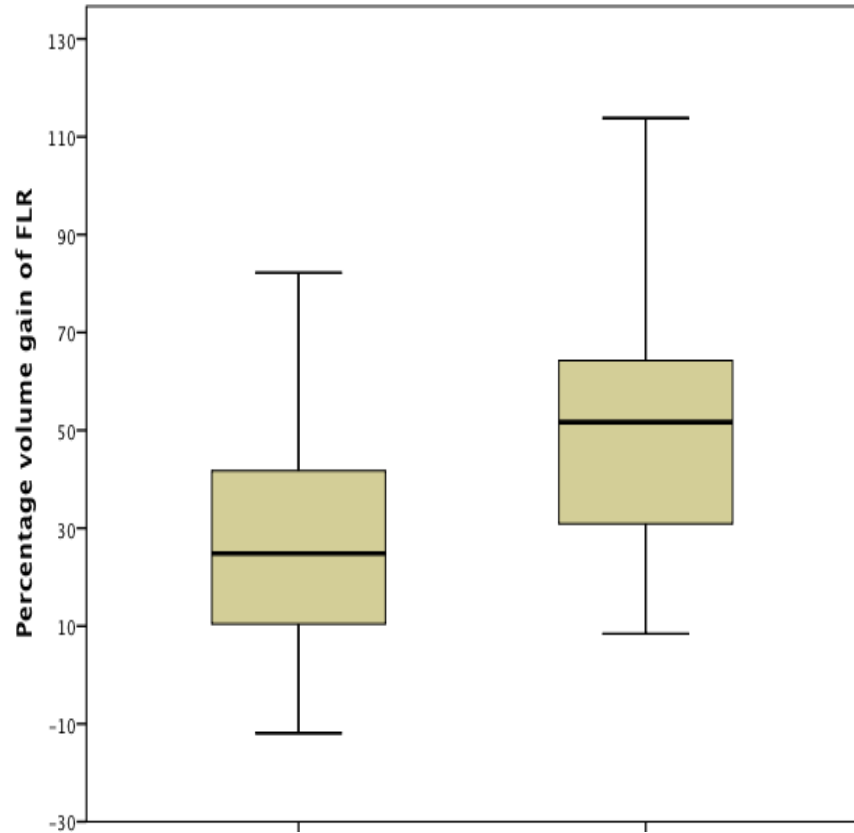
TELV: total estimated liver volume

TELV = (total liver volume – 706,2) × body surface area + 2,4

- FLR volume change following right PVE

Author, year	Embolic agent	N (Patients)	FLR change (%)
NBCA			
De Baere-T Ann Surg Oncol 2010	NBCA	107	58%
Azoulay-D, Ann Surg 2000	NBCA	30	46%
Giraud-G, Surgery 2008	NBCA	146	42%
Sirichindakul-B, Hepatogastroenterolog 2007	NBCA	29	28%
Particles only			
Covey-AM, Ann Surg 2005	PVA	39	24%
Geisel-D, CVIR 2014	PVA	40	30%
Particles & coil/Plug			
Geisel-D, CVIR 2014	PVA & coil/plug	35	53%
Camelo-R, J Oncol 2019	PVE & coil	64	35%
Madoff-D, 2003	PVA & coil	26	41%
Ethanol			
Ji-W, World J Gastroenterol 2003	Ethanol	47	27%
Tsurusaki-M, Br J Radiol 2018	Ethanol	19	40%
Gelatin sponge			
Imamura-H, Hepatology 1991	Gelatin sponge	84	31%

Results



Particles only

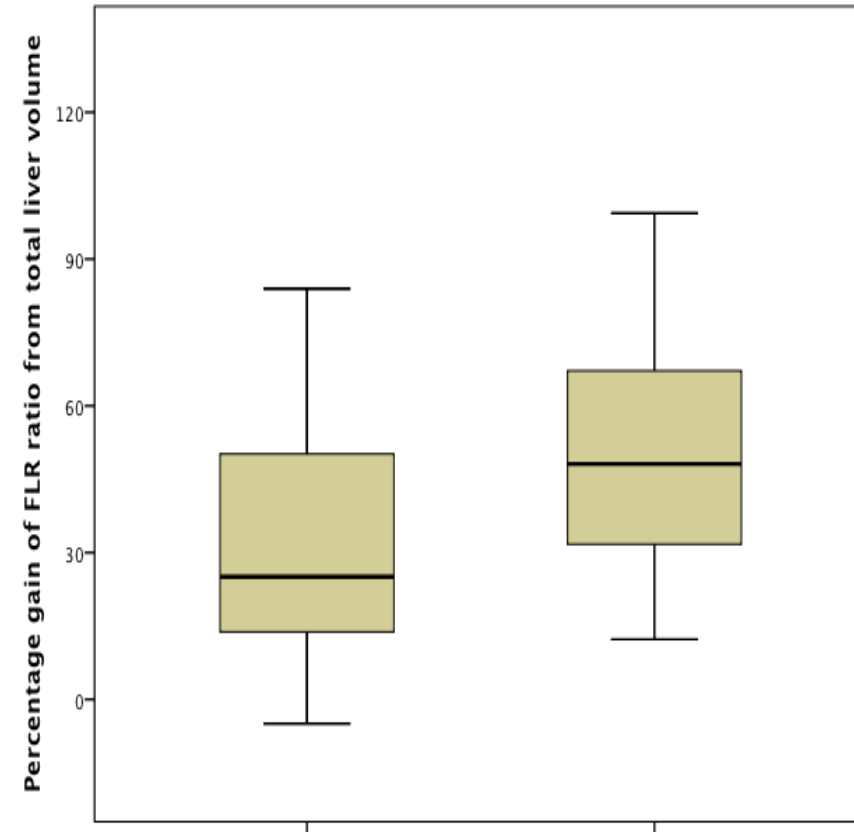
+ Plug/Coil

$30.1 \pm 28.8 \%$

$53.3 \pm 34.5 \%$

$P = 0.003$

Geisel D, CVIR 2014



Particles only

+ Plug/Coil

$31.9 \pm 26.6 \%$

$49.5 \pm 24.2 \%$

$P = 0.004$

Charité Berlin: Interventional technique

- US guided puncture of central (right) PV with 22 G Ciba needle
- 0,018“ guide wire, introduction of a COOK NEFF set and exchange to 0,035“ steel guide wire
- long brite tip 4F sheath into PV
- portography with DSA in 45° RAO projection
- introduction and configuration of 4F sidewinder I (or II) catheter with 0,038” ID
- fluoroscopy guided embolisation using particles and coils
- selective embolisation of seg. 4 branches only in selected cases
- during sheath withdrawal channel embolisation with fibrin glue

Analogo sedation

- 15 mg Piritramid (Dipidolor[®])
- 10 mg Metoclopramid (Paspertin[®])

- 1-5 mg Midazolam (Dormicum[®])

Transiliocolic (intraoperative) PVE

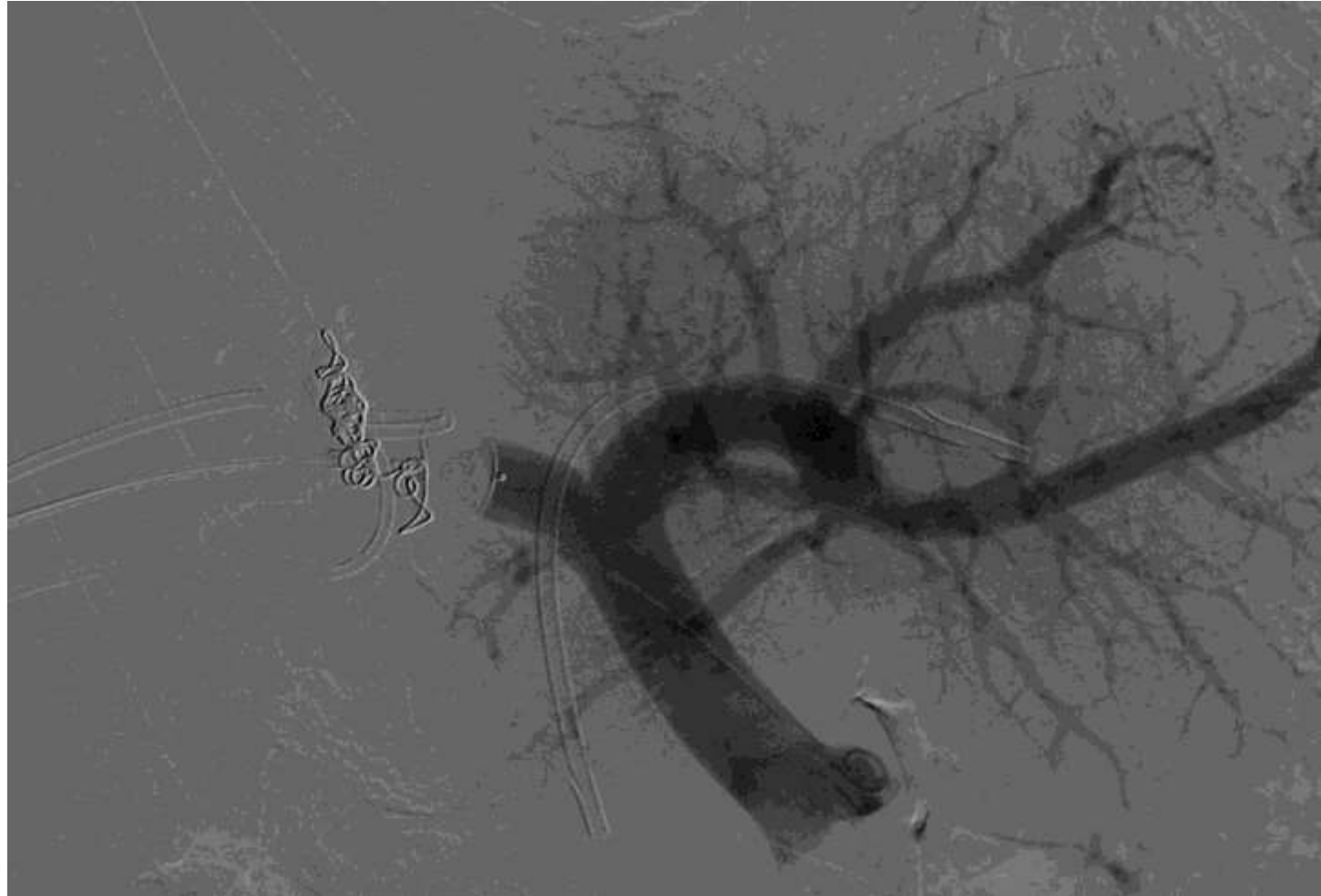


Single-incision laparoscopic surgery portal vein embolization (SILS-PVE)



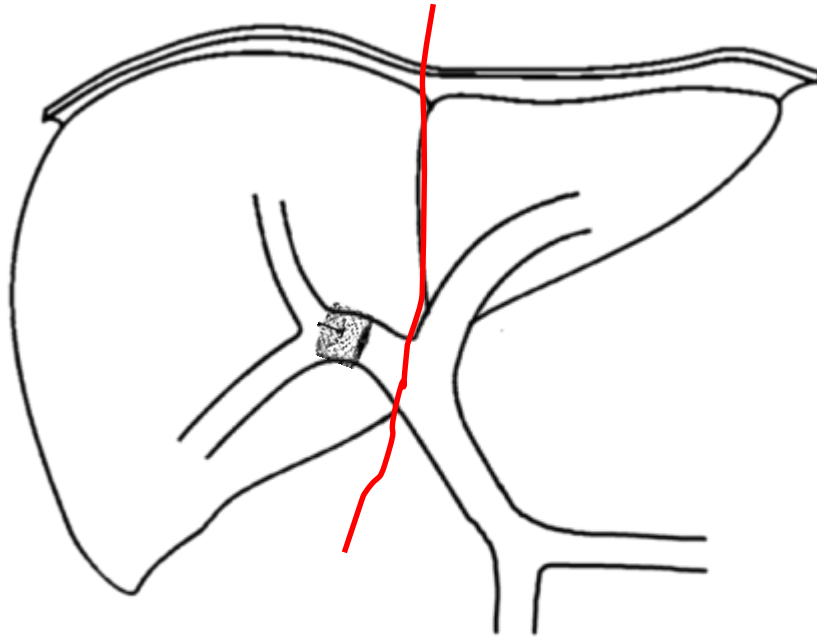
Single-incision laparoscopic surgery portal vein embolization (SILS-PVE)

PVE with PVA & Plug

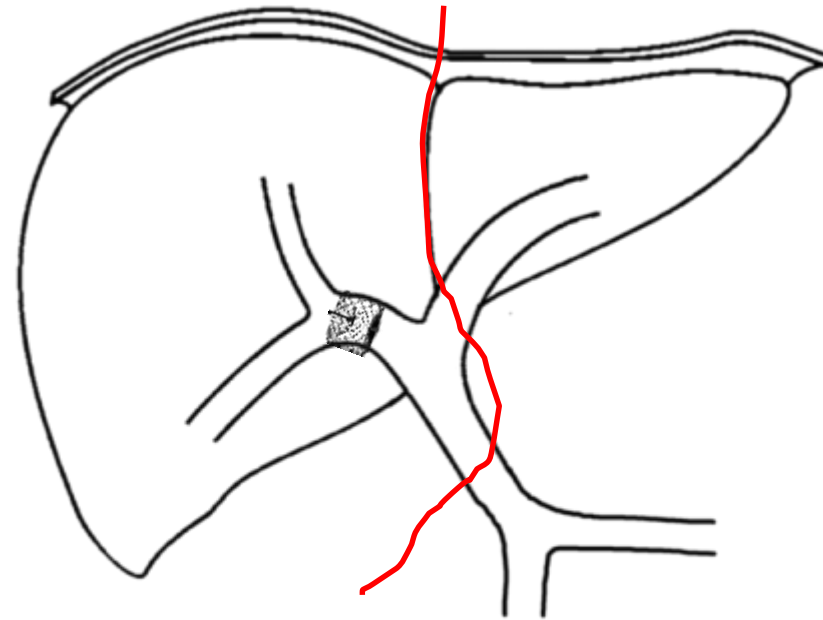


Interdisciplinary agreement

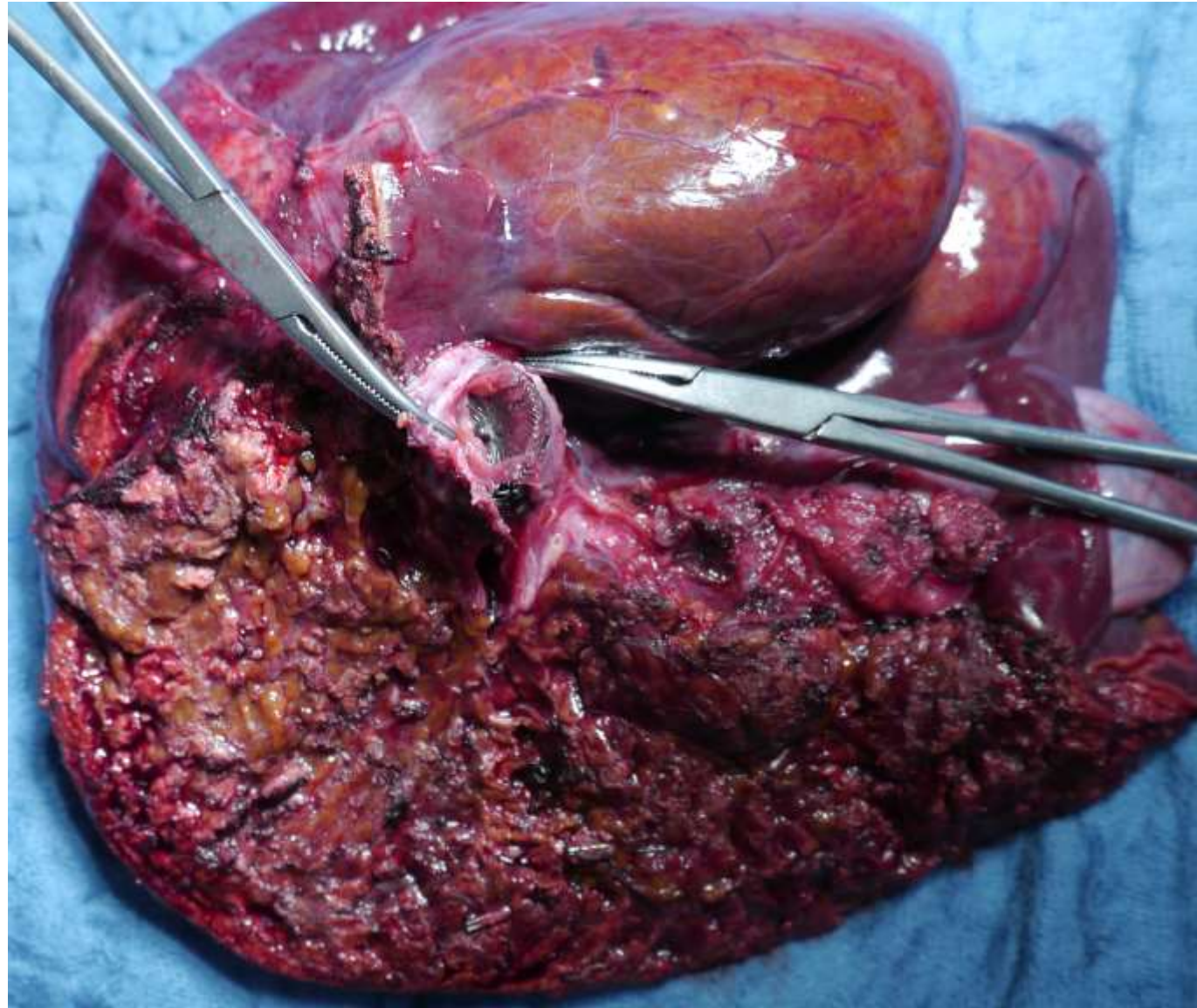
Liver metastasis



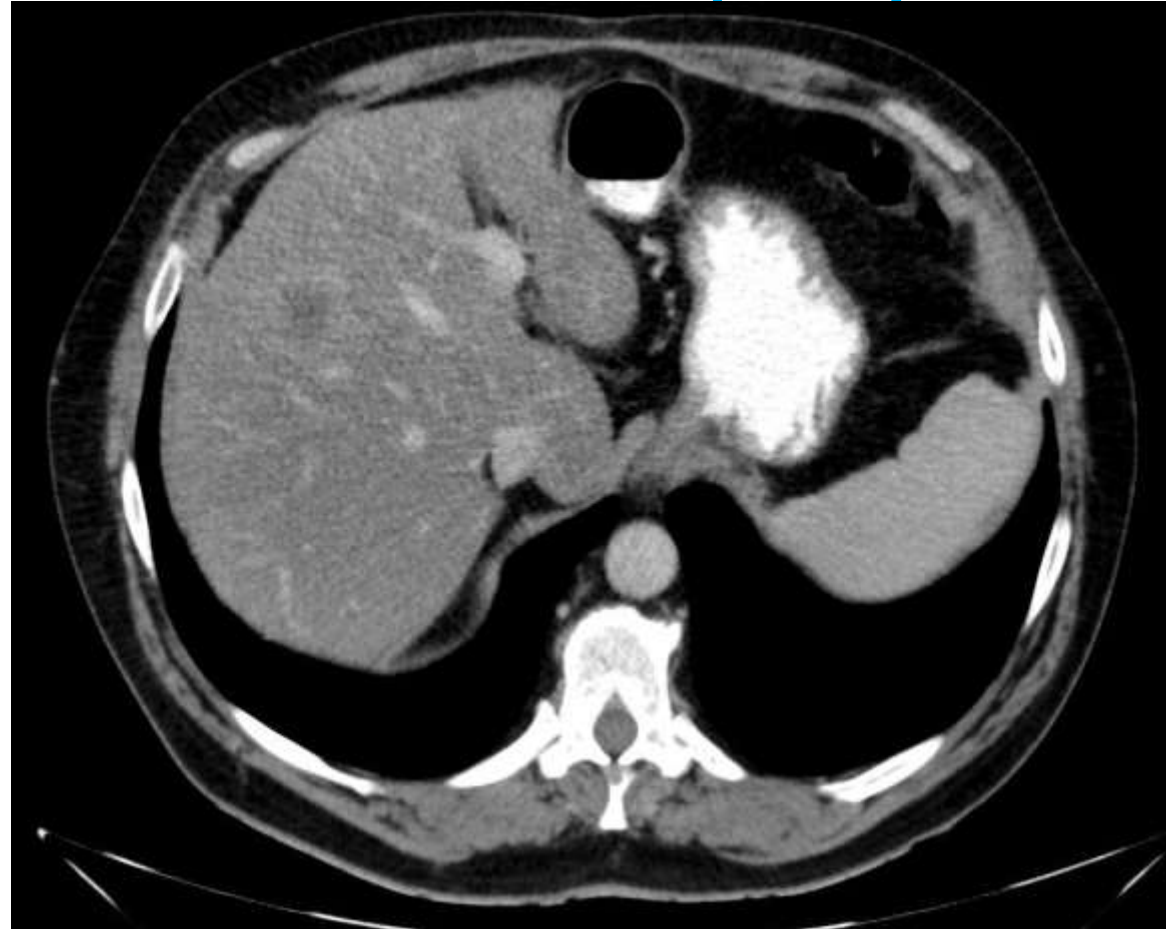
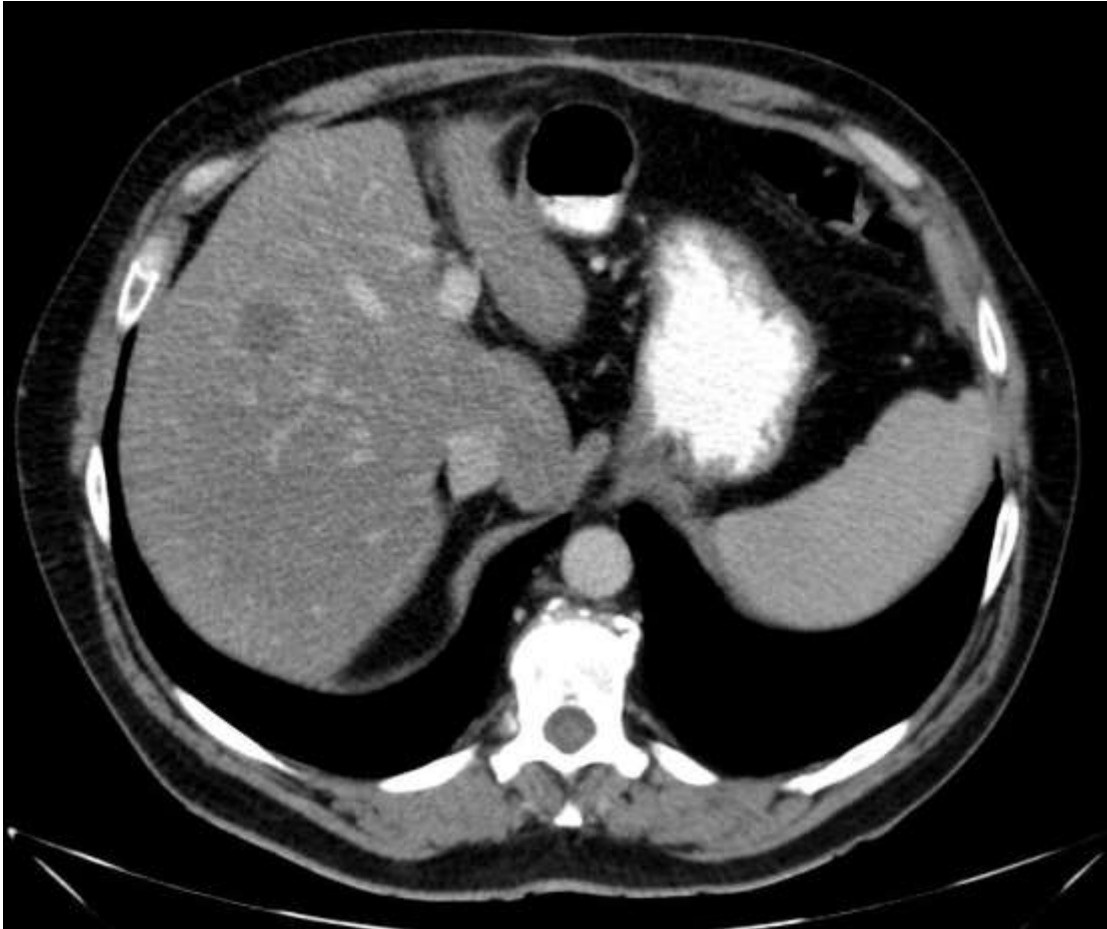
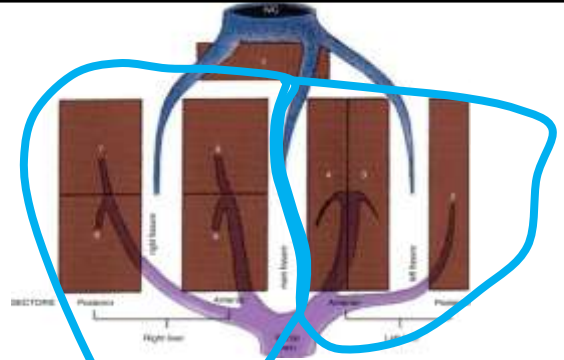
Colangiocarcinoma
Klatskin's Tumor



➤ distance between Coil/Plug and portal vein bifurcation ≥ 10 mm



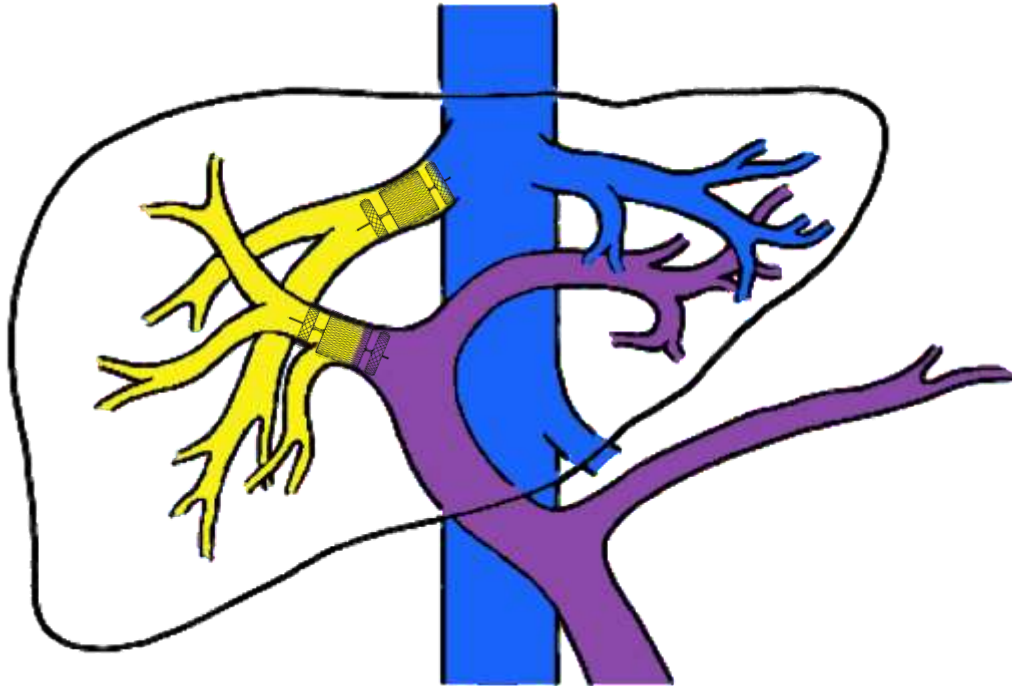
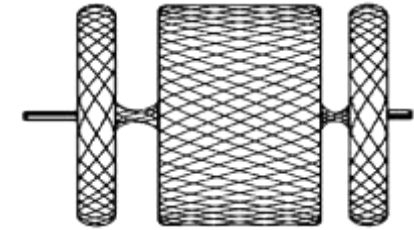
Segment 4?



Augmented PVE

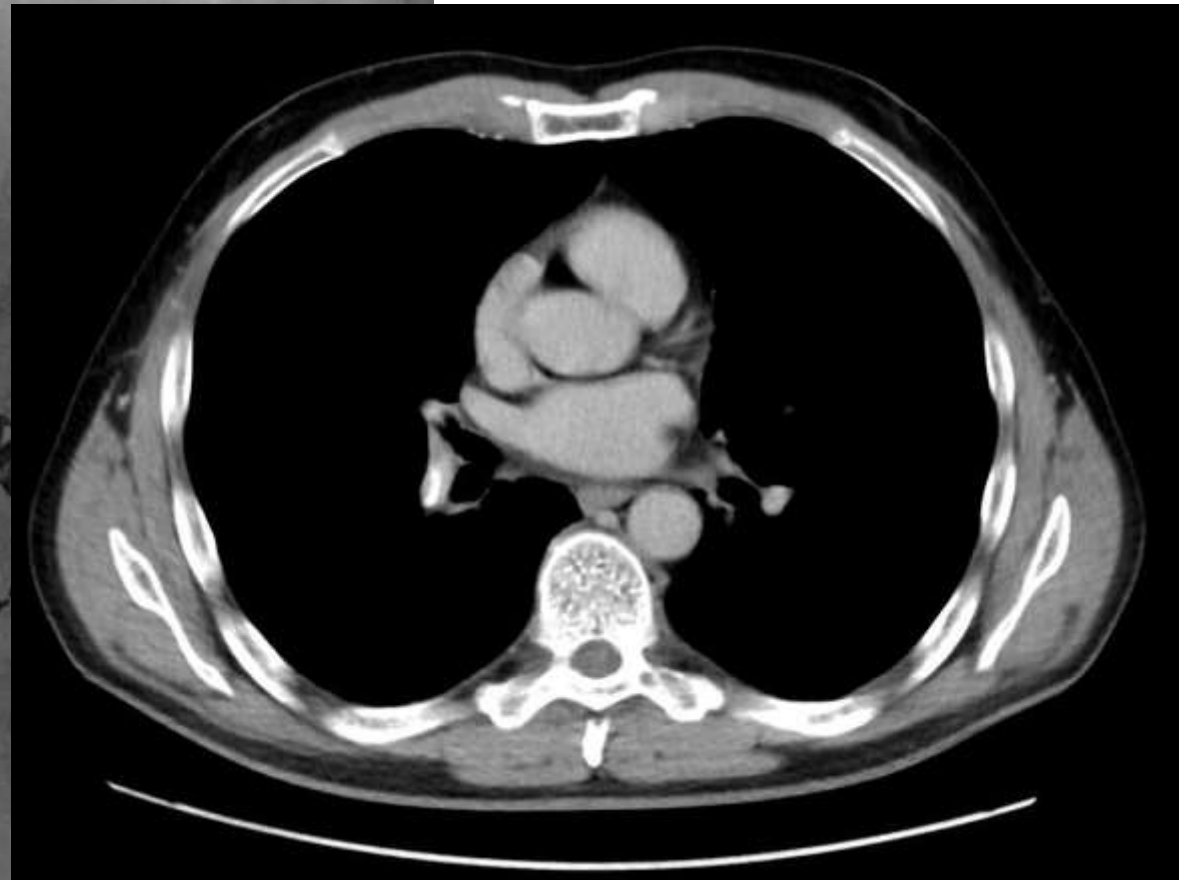
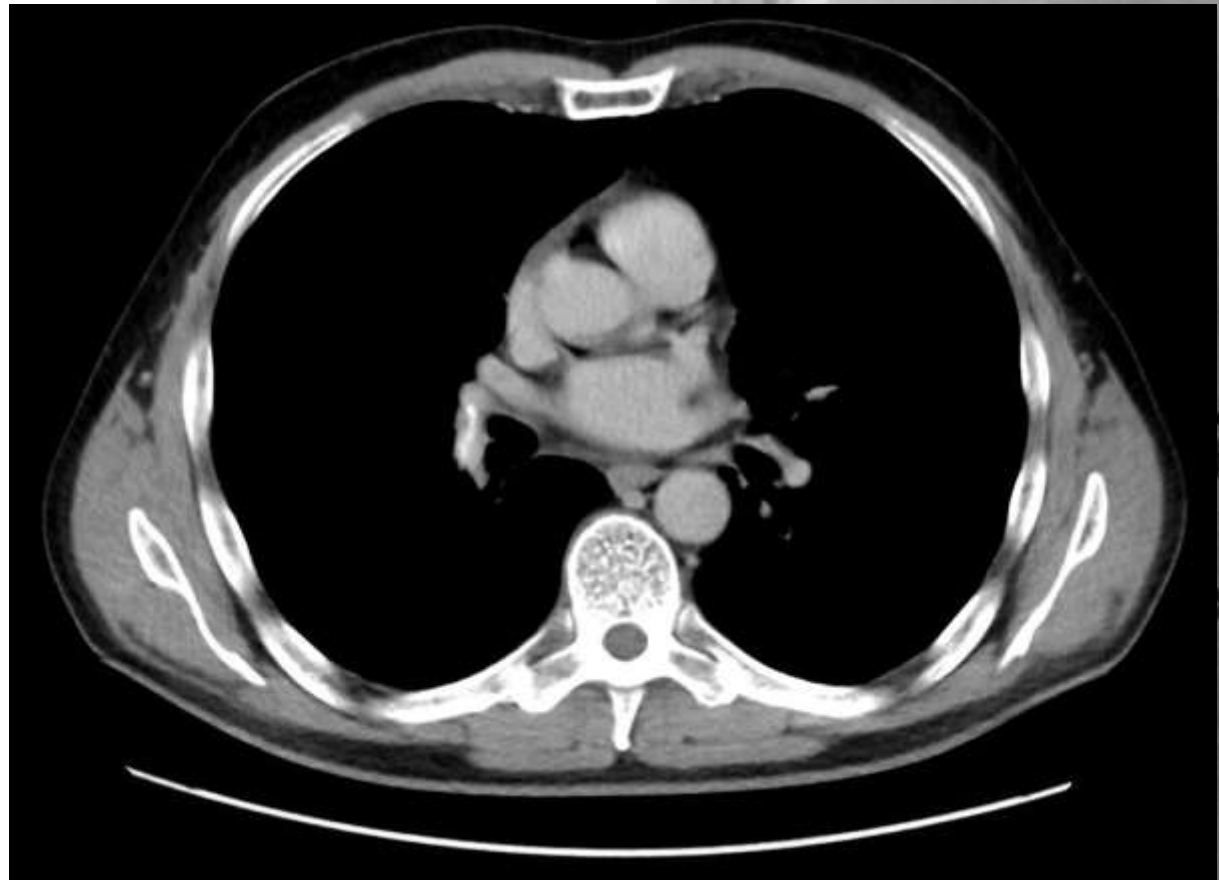
- ALPPS : associating liver partition and portal vein ligation for staged hepatectomy
- PVE & arterial embolisation
- PVE & hepatic vein embolisation (deprivation)
- PVE & stem cell injection in FLR

Combination portal and hepatic vein embolization (PVE & HVE)



Guiu-B, Eur Radiol. 2017; Hocquelet-A, CVIR 2018; Hwang-S, World J Surg 2015; Hwang-S, Ann Surg 2009; Gi-Young Ko-GY, J Hepatobiliary Pancreat Sci 2010

Non-target Embolization



Summary

- access site (our approach: ipsilateral, transhepatic)
- embolisation material (our approach: PVE and plugs)
- PVE is a relatively safe intervention

SIR quality improvement guidelines

- threshold for PVE related major compl. 6%
- morbidity 11%

Metaanalysis by Abulkhir-A, Ann Surg 2008

- 1088 PVEs
- PVE-related morbidity 2.2%
- PVE-related mortality 0%

Thank you

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