Management of Colorectal Liver Metastases

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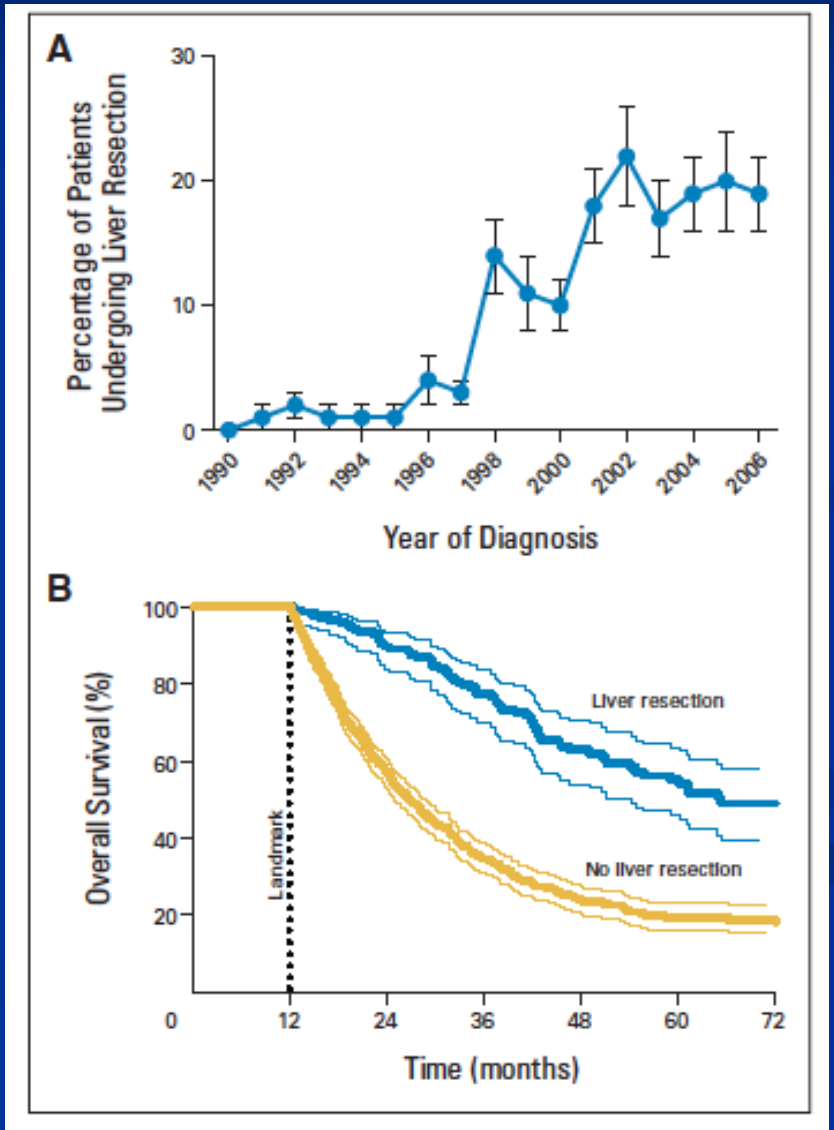
- 50% of patients with colorectal cancer develop liver metastasis
- 30% present with synchronous liver metastasis
- In 40% of cases the liver is the only site of metastasis
- Liver metastasis resectable in 10-20% of cases

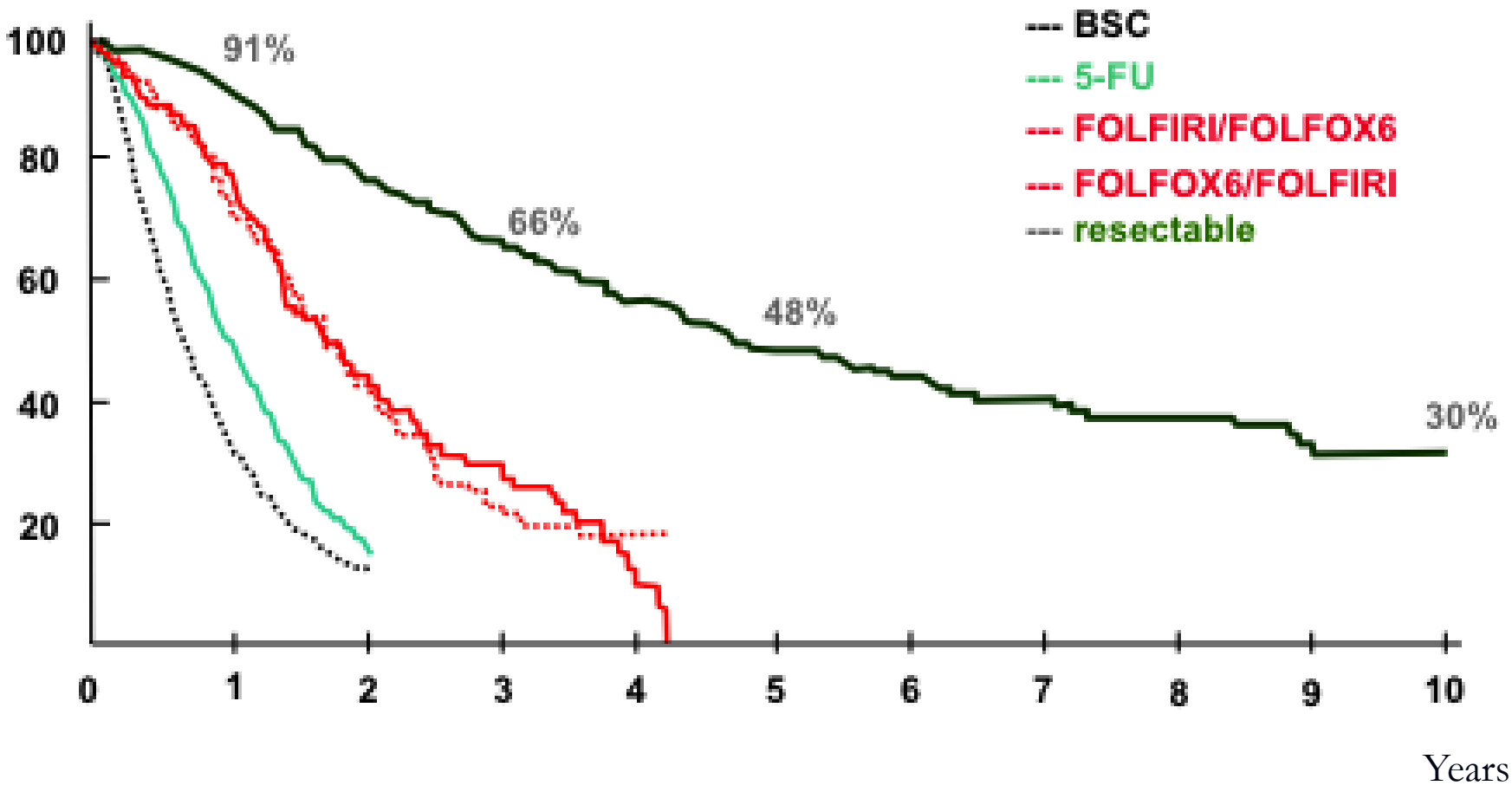
Rationale for surgery in colorectal liver metastasis

- Five year survival after resection of liver metastasis is 30%
- Only chance of long term survival



J Clin Oncol 2009;27:3677

Metastatic colorectal cancer: Survival



Colon Cancer Collaborative Group, BMJ / Tournigand, JCO / Adam, Ann Surg

Resectability

- Complete (R0) resection with a liver remnant consisting of at least two segments with preserved inflow, outflow and biliary drainage.
- Volume of liver remnant should not be less than 20-30% of total liver volume
- Primary and extra hepatic disease should be resectable

Traditional Contraindications

- Bilobar disease
- > 4 liver metastases
- Large tumours (>10cm)
- Extraheptic disease

None are considered an absolute contraindication although they do have **prognostic significance**

When is surgery contraindicated

- Unfit for surgery
- Uncontrolled primary disease
- Untreatable extra-hepatic disease
- Extensive intra-hepatic disease
  - Inadequate residual volume after an R0 resection
  - Caudate lobe involving the IVC
  - Portal vein confluence
  - Hepatic veins and IVC involved

Untreatable extra-hepatic disease includes

- Widespread pulmonary disease
- Peritoneal disease
- Extensive nodal disease (retroperitoneal or portal)


03.08.14
-30.5
130
1.0

When is surgery appropriate?

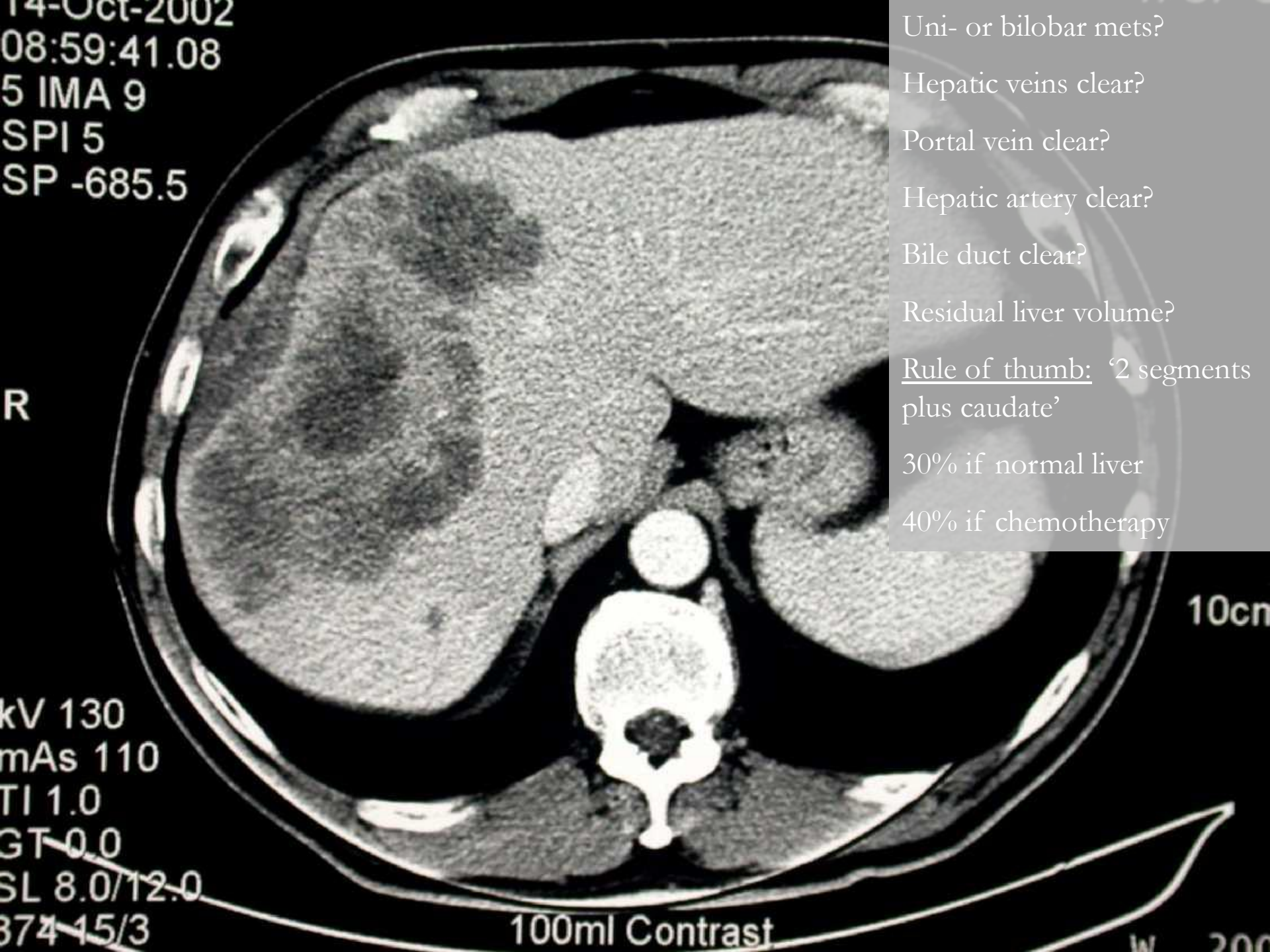
- Controllable extrahepatic disease
  - Resectable/ablatable pulmonary disease
  - Resectable isolated extrahepatic sites, spleen adrenal
  - Local direct extension involving diaphragm, adrenal

Preoperative evaluation

- Accurate staging is essential
- Biopsy of a liver lesion is not necessary
- CT
  - Sensitivity 75%

J Clin Oncol 2010;102:909

- MRI
  - Sensitivity 81%
  - Contrast MRI is the best modality for detection and charecterisation of liver lesions
- FDG-PET
  - most sensitive means of demonstrating extra hepatic disease
  - May restage up to 28% of patients
  - More likely to change management with increasing disease severity



Uni- or bilobar mets?

Hepatic veins clear?

Portal vein clear?

Hepatic artery clear?

Bile duct clear?

Residual liver volume?

Rule of thumb: '2 segments plus caudate'

30% if normal liver

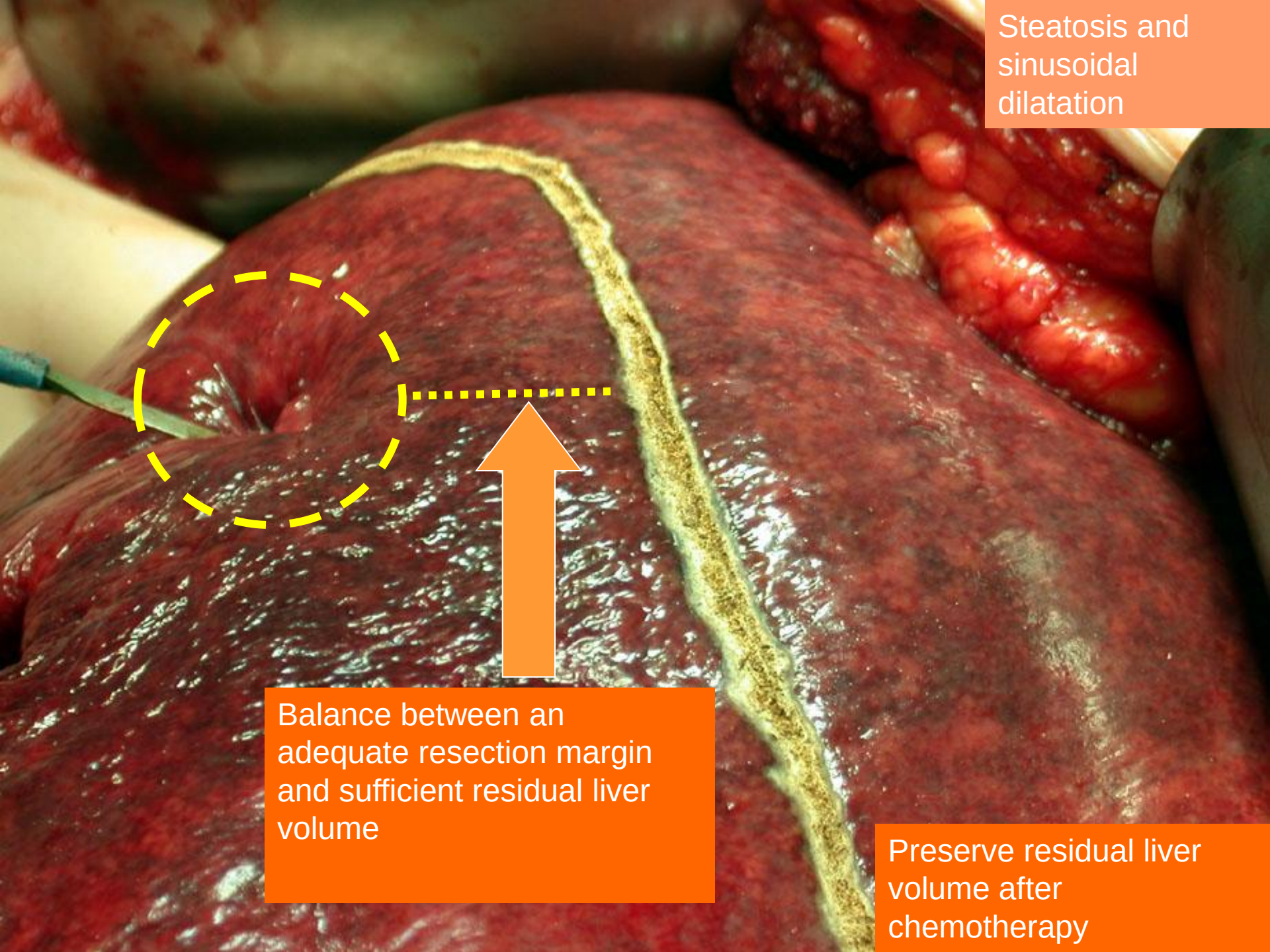
40% if chemotherapy

Chemotherapy Recurrence = Achilles heel of liver resection

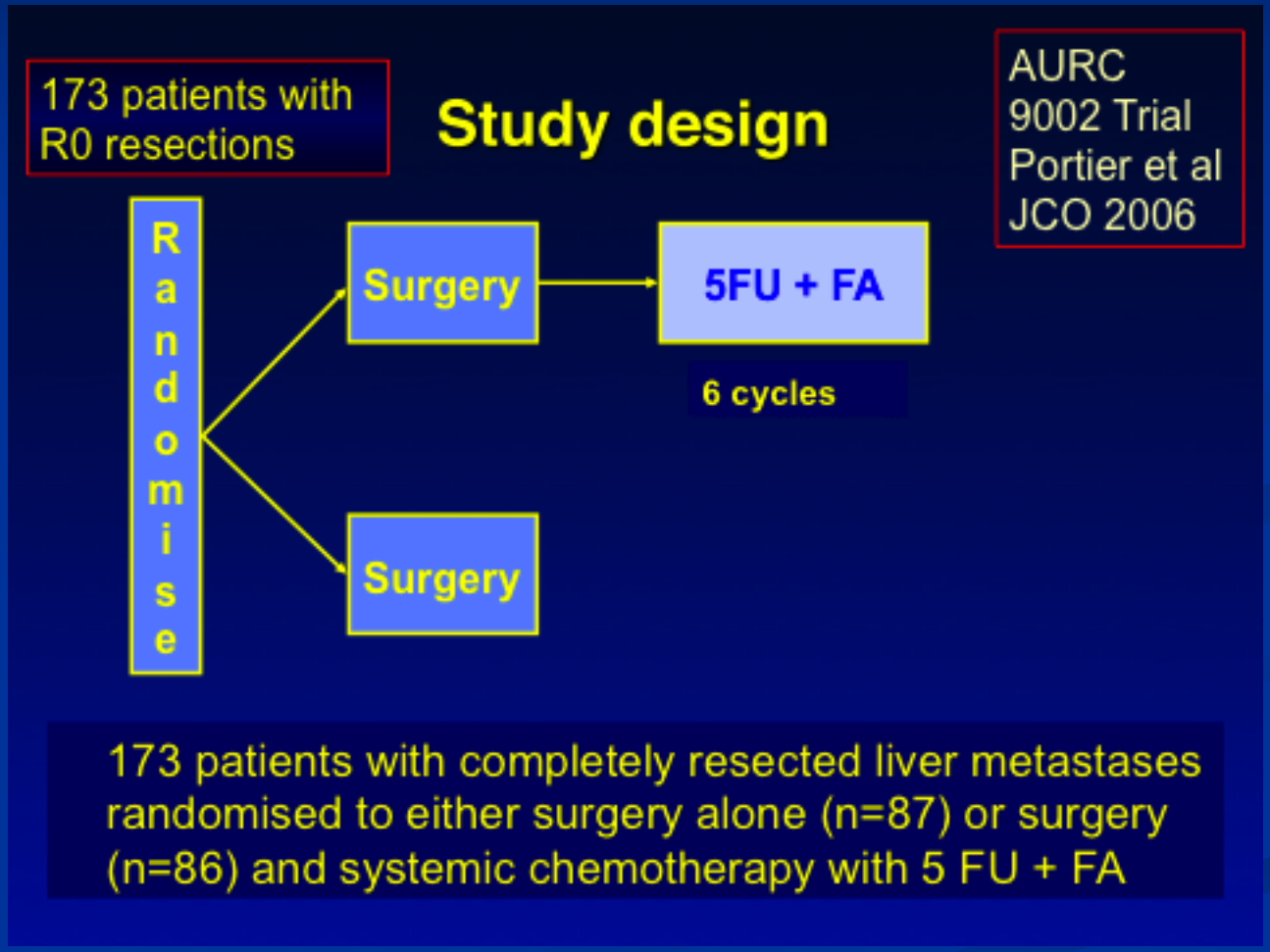
- Recurrent disease develops in 70% of patients who undergo a liver resection
- Chemotherapy has been shown to improve survival
- Timing of the chemotherapy remains controversial
- Conversion chemotherapy - chemotherapy is given to downsize potentially resectable metastasis into resectable disease

Chemotherapy related liver toxicity

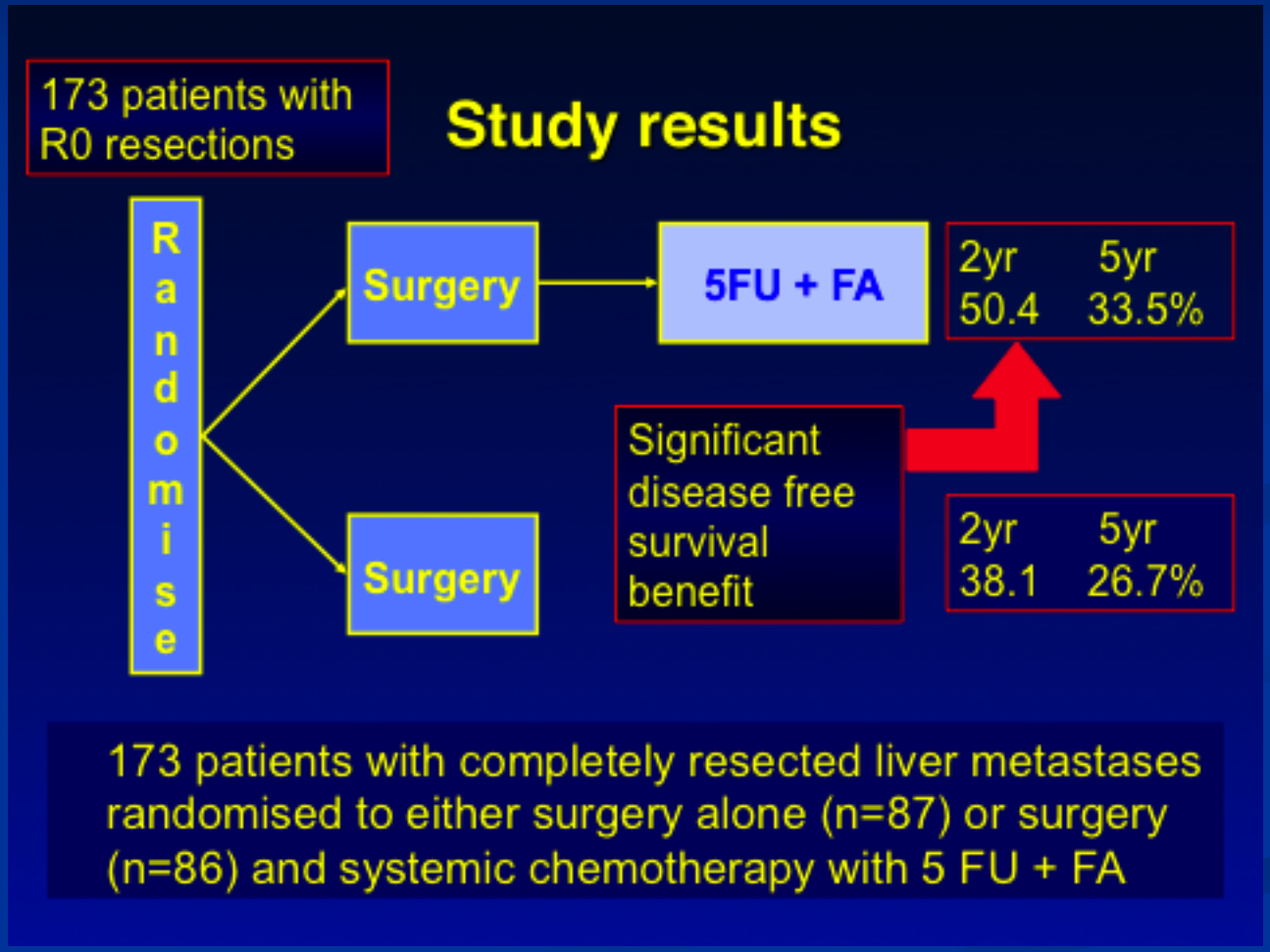
- Irinotecan – chemotherapy-associated steatohepatitis (CASH)
- Oxaliplatin – sinusoidal obstruction syndrome
- Bevacizumab – impaired wound healing and liver regeneration


Steatosis and sinusoidal dilatation
Balance between an adequate resection margin and sufficient residual liver volume
Preserve residual liver volume after chemotherapy

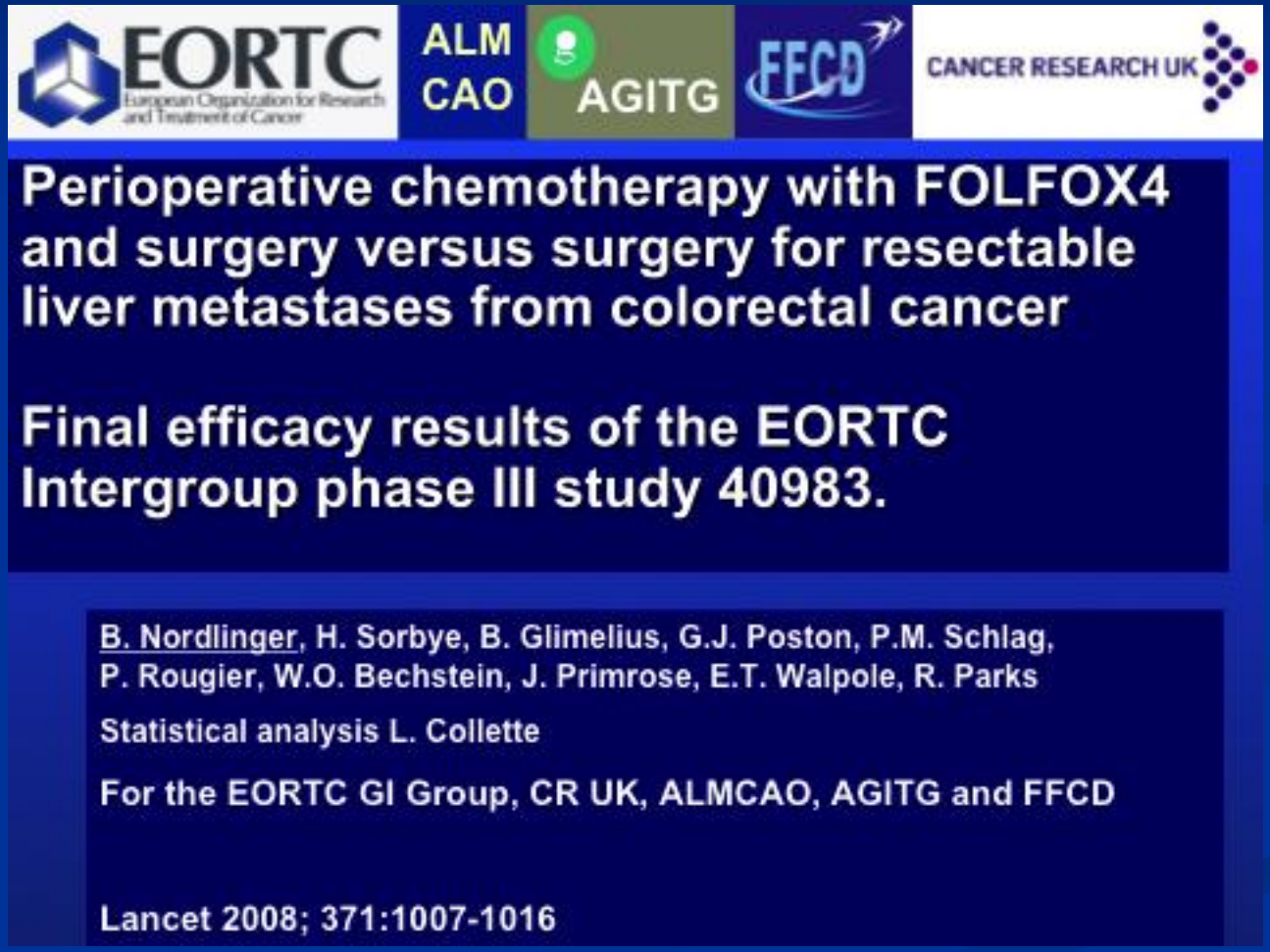
Postoperative Chemotherapy



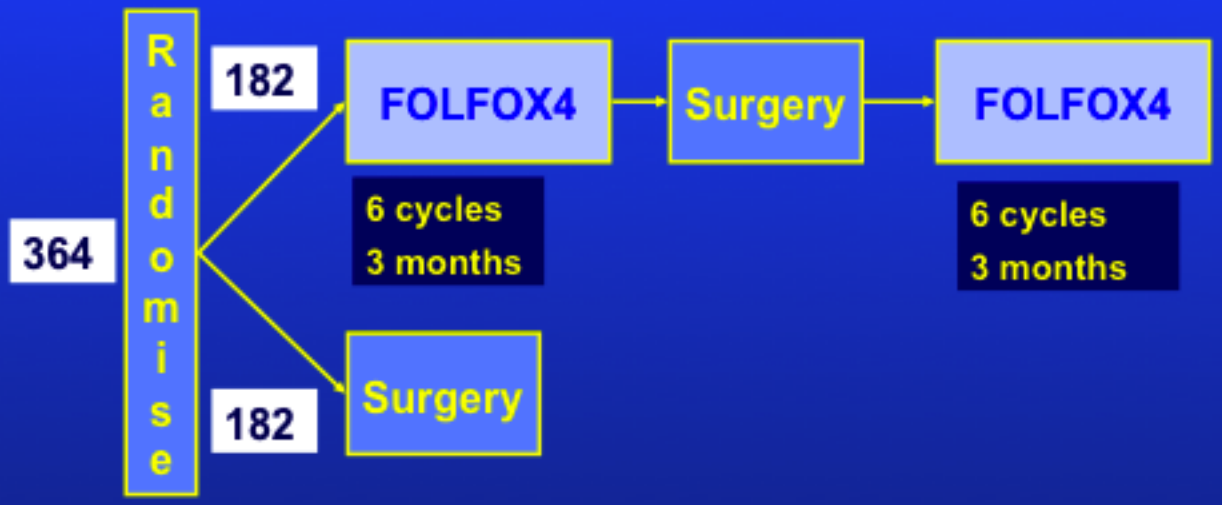
Postoperative Chemotherapy



Preoperative chemotherapy



Study design



364 patients with up to 4 liver metastases randomised to either chemotherapy and surgery (n=182) or surgery alone (n=182)

Complications of surgery

	Peri-op CTx	Surgery
Post-operative complications*	**40 /159 (25.2%)**	**27 / 170 (15 .9 %)**
Cardio-pulmonary failure	3	2
Bleeding	3	3
Biliary fistula	12	5
(output >100ml/d, >10d)	*(9)*	*(2)*
Hepatic failure	11	8
(bilirubin>10mg/dl, >3d)	*(10)*	*(5)*
Wound infection	4	4
Intra-abdominal infection	8	2
Need for reoperation	5	3
Other	25	16
Post-operative death	**1 patient**	**2 patients**

*P=0.04

Results

Surgery only

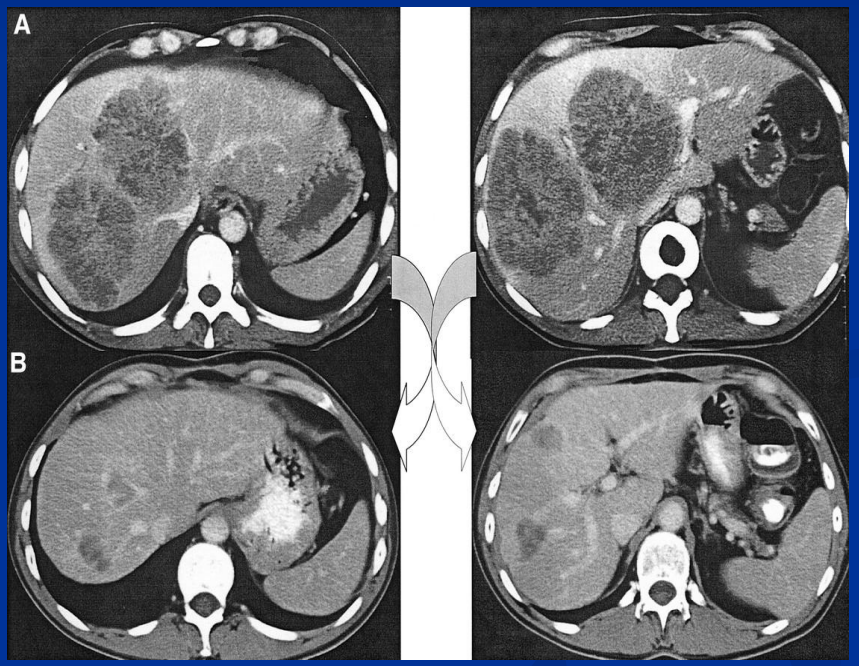
- 84% had successful resections
- 11% non-therapeutic laparotomy rate
- 5y progression free survival 28%
- 5y overall survival 48%

Perioperative chemotherapy

- 83% had successful resections
  - 67/182 had an objective response (4 complete)
  - 11/182 progressed on chemo
- 5% non-therapeutic laparotomy rate
- 5y progression free survival 35%
- 5y overall survival 52%

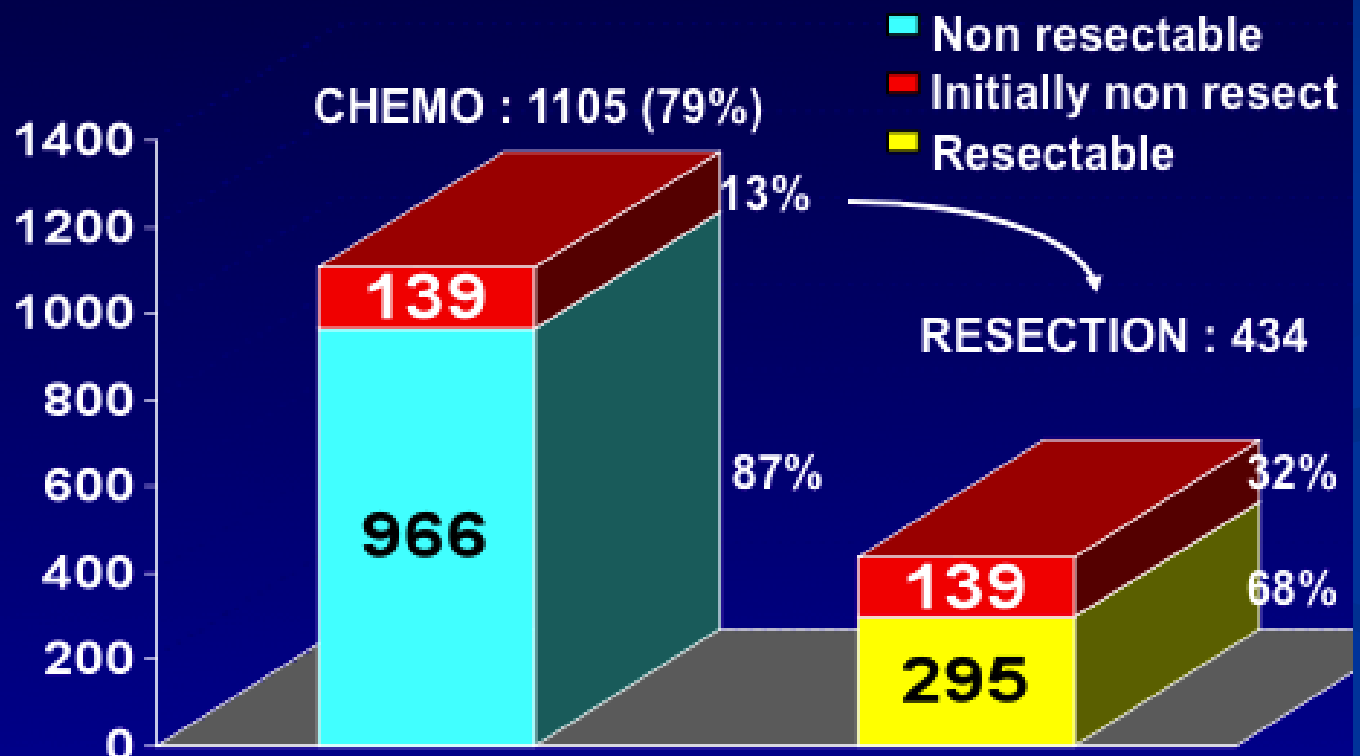
Conversion Chemotherapy

- Conversion of initially irresectable hepatic metastasis into resectable disease (Conversion Chemo)
- Definition of initially unresectable is subjective
- Conversion rates of 5-40%



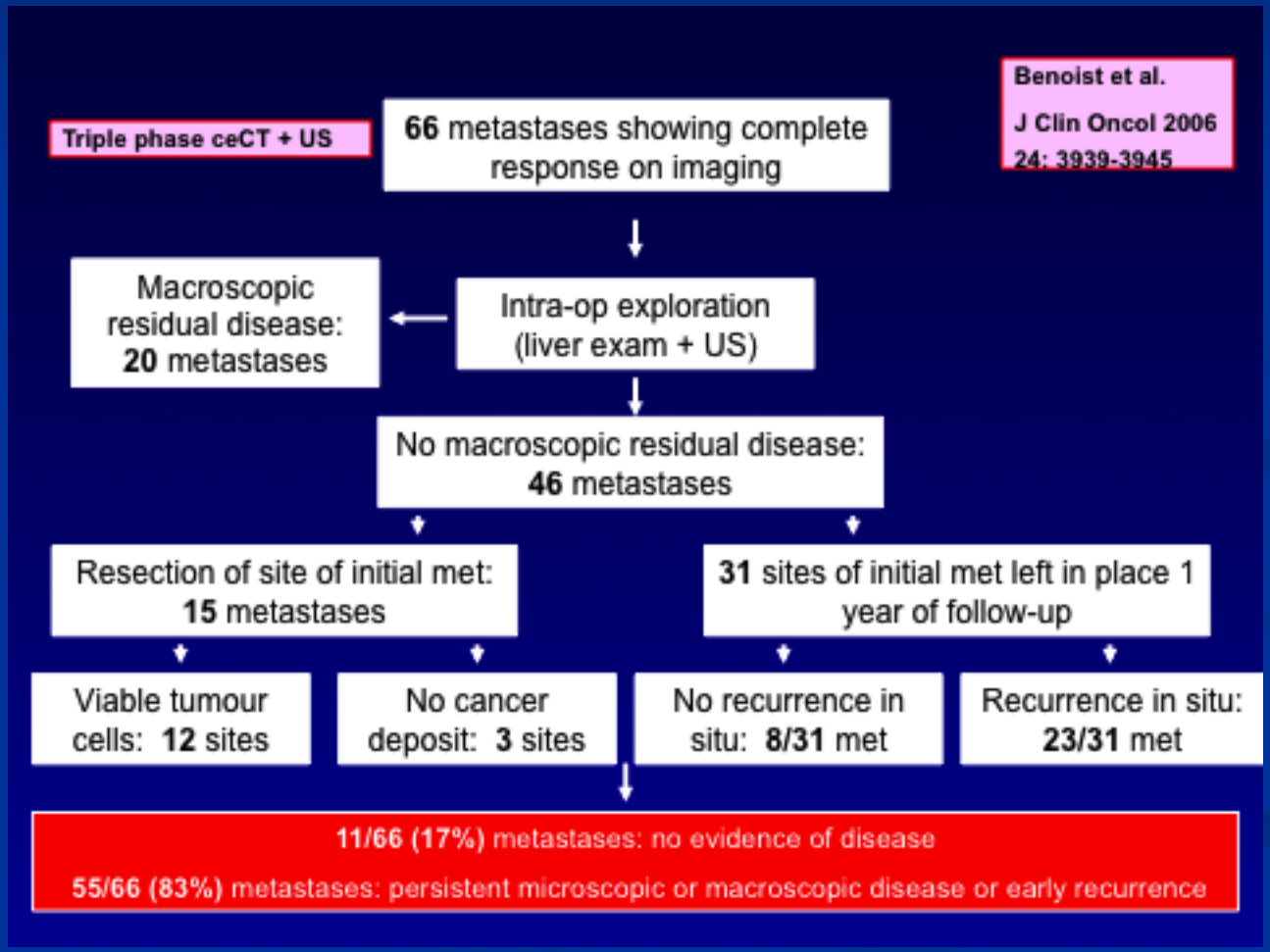
Colorectal liver metastases

Paul Brousse Hospital - 1400 patients (1988 - 2000)



Adam Rene et al. Ann Surg Oncol 2004

Complete Radiological Response

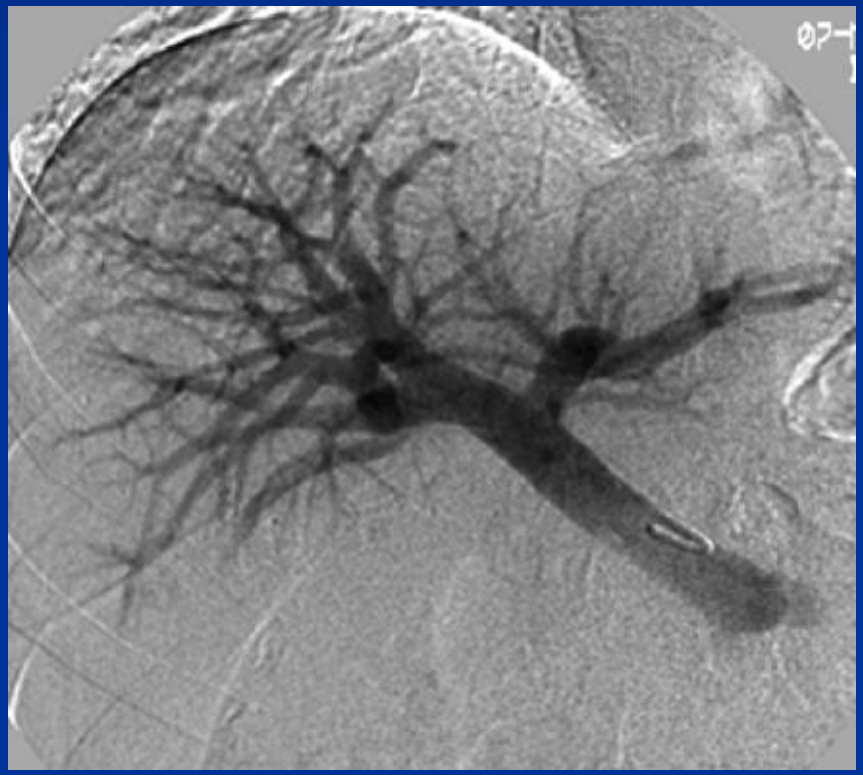


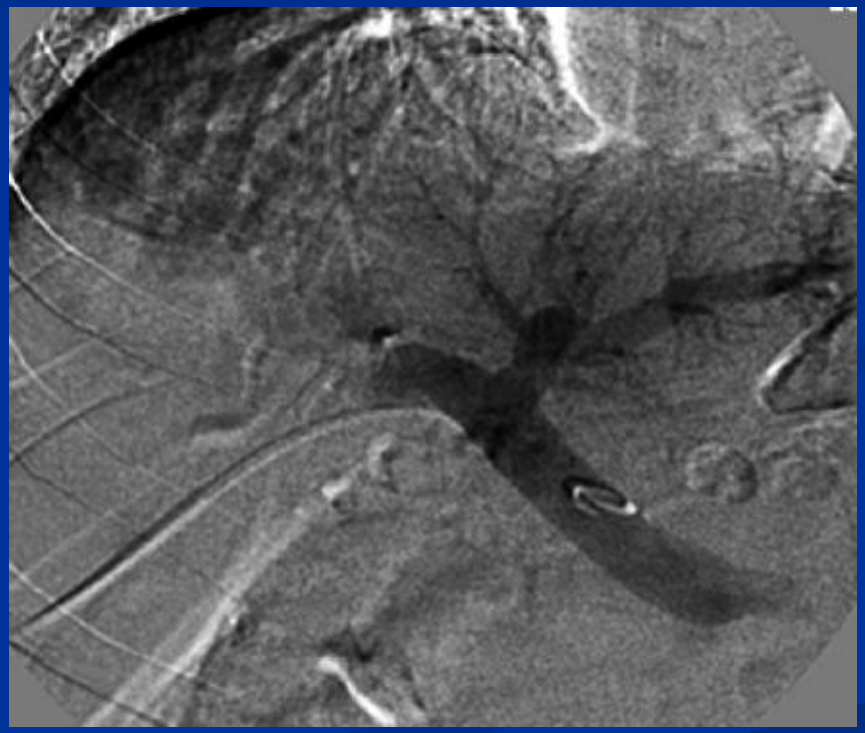
Strategies to prevent postoperative liver failure

- Risk of postoperative liver failure is greatest with extensive liver resections – functional residual volume < 30%

- Portal Vein Embolisation
  - Ipsilateral atrophy, contralateral hypertrophy
  - Gelfoam, lipiodol, cyanoacrylate, fibrin
  - Increase in volume 15% of total liver volume
  - Maximum effect 3-9weeks

- Staged resection
  - Multiple bilobar disease
  - Clearance of one hemiliver followed by embolistion of the contralateral side
  - Resection of the contralateral side





Timing of Resection

- Patients with synchronous liver metastasis have traditionally had staged surgery
- Synchronous resection can be safely performed
- Usually reserved for simple resections
  - E.g. Right hemicolectomy/ segment 2/3 resection

Ablative Therapy

Thermo-ablative

- Cryotherapy
- Radiofrequency ablation (RFA)
- Microwave Ablation

Chemo-ablative

- Acetic acid
- Ethanol

Ablative Therapy

Radiofrequency Ablation

- Alternating current with frequency of 350-480KHz
- Oscillation of tissue ions causes frictional heat – coagulative necrosis

Microwave Ablation

- Microwaves with a frequency of 900MHz
- Agitate water molecules causing frictional heat and coagulative necrosis

- Quicker than RFA
- Not limited by tissue desiccation

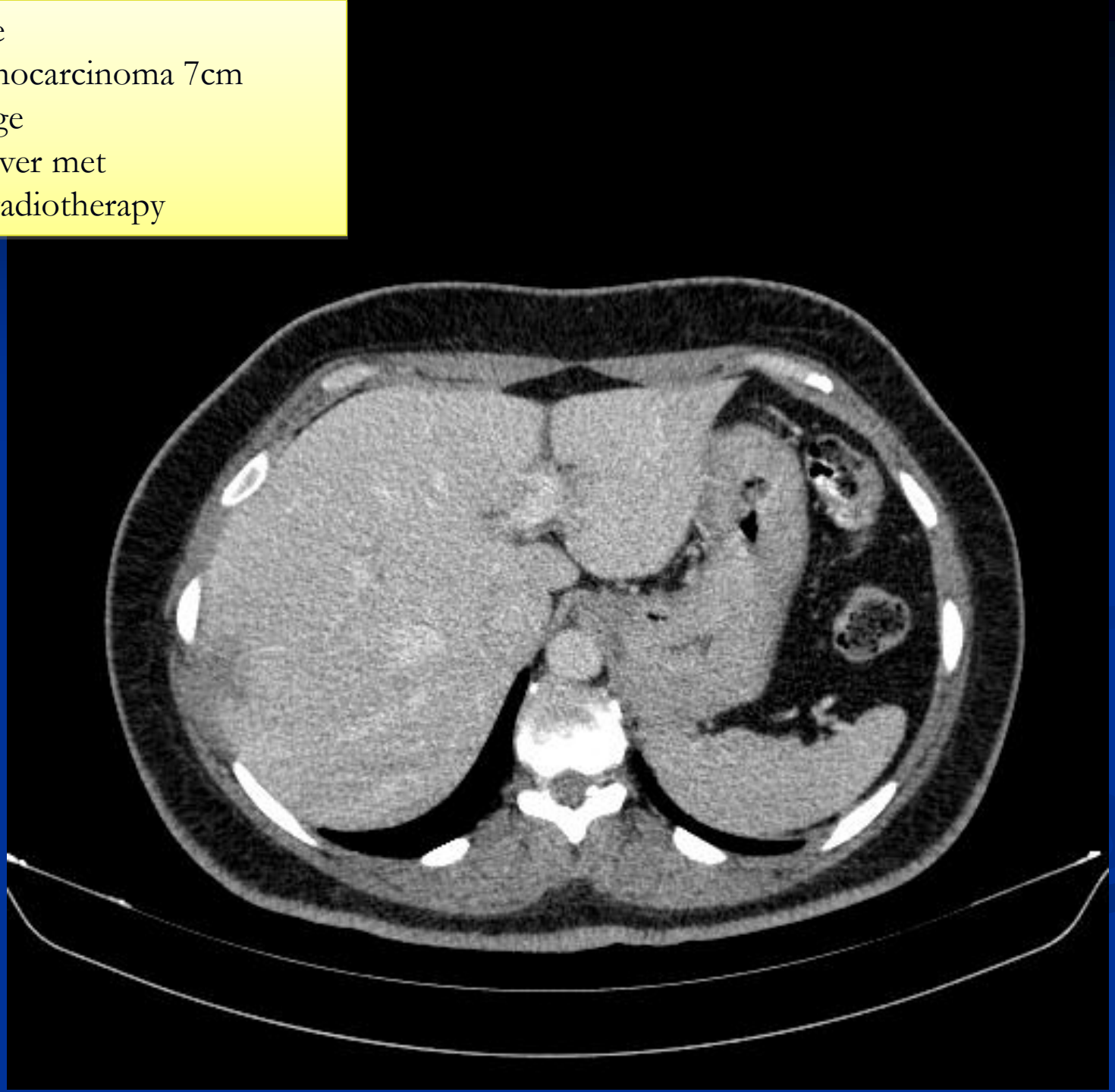
Ablative Therapy

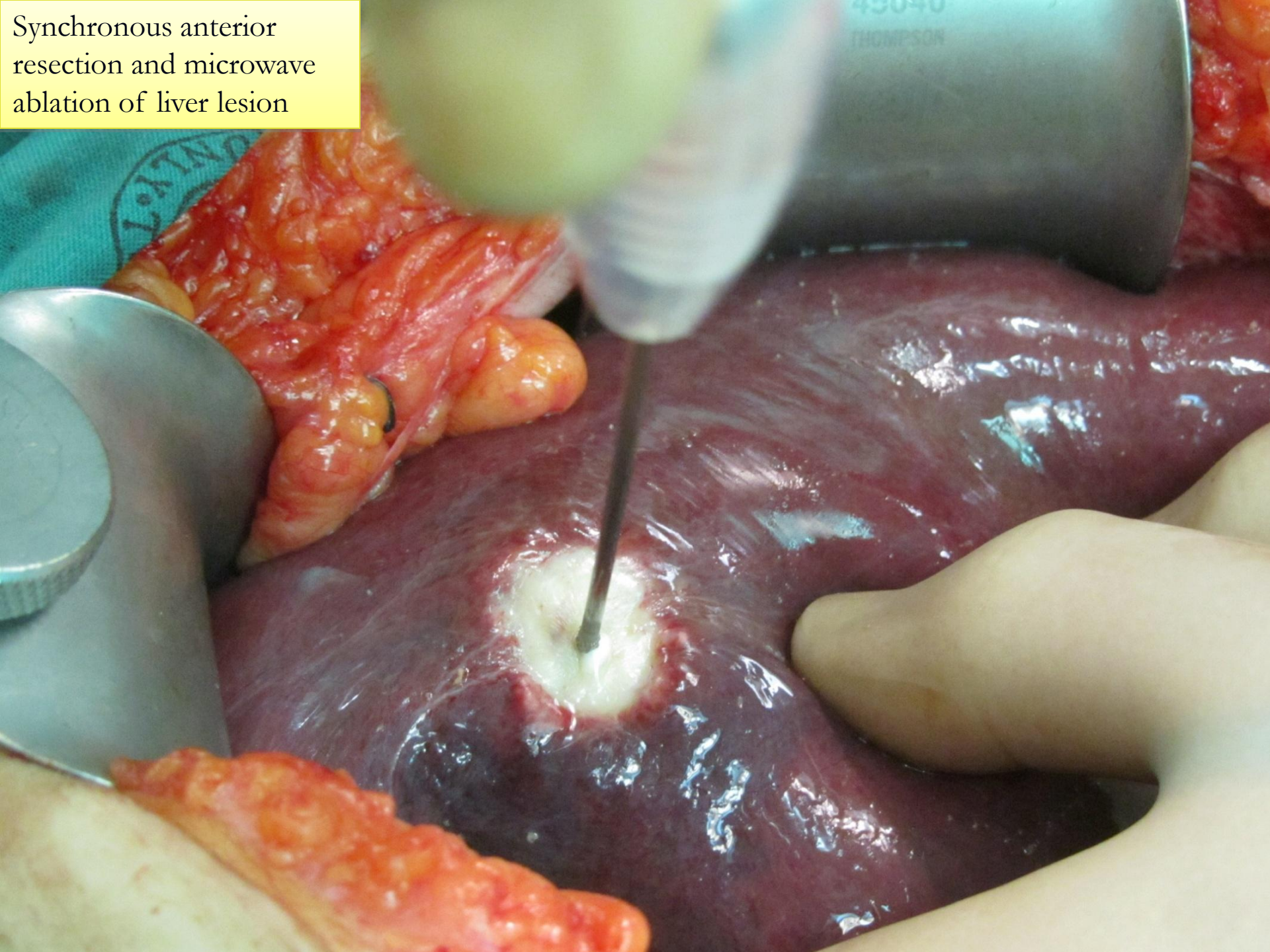
- Open, laparoscopic or percutaneous
- Lack of good evidence. No randomised trial comparing ablation to resection
- Higher local recurrence rate, inferior disease free survival
- Liver metastasis not amenable to curative resection
  - Location
  - Multifocality
  - Inadequate hepatic reserve

Complications

- Biloma
- Abscess
- Thermal injury to surrounding structures
- Haemorrhage
- Haemobilia

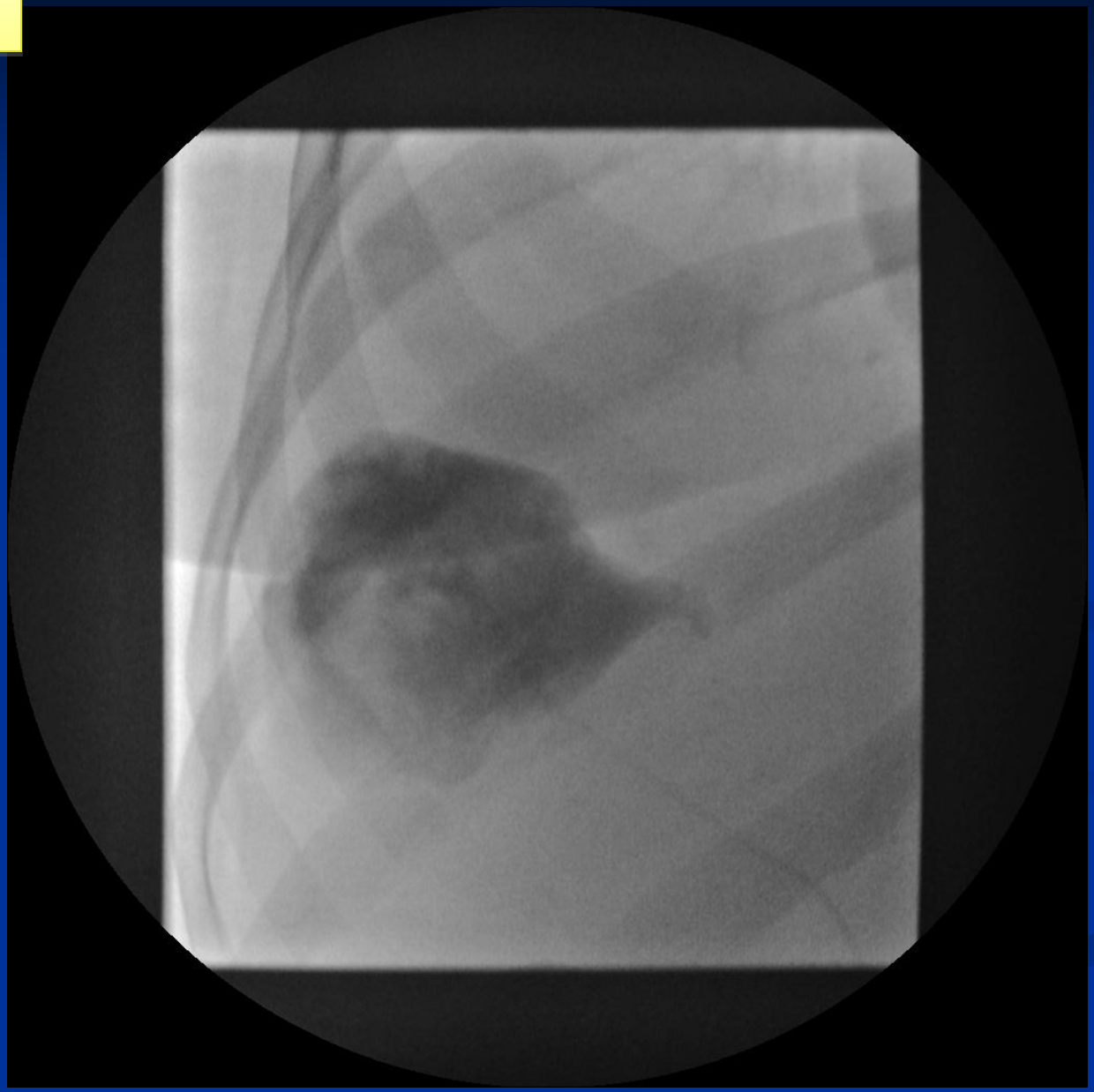
53 y old female
T3 Rectal adenocarcinoma 7cm above anal verge
Synchronous liver met
Pre-operative radiotherapy



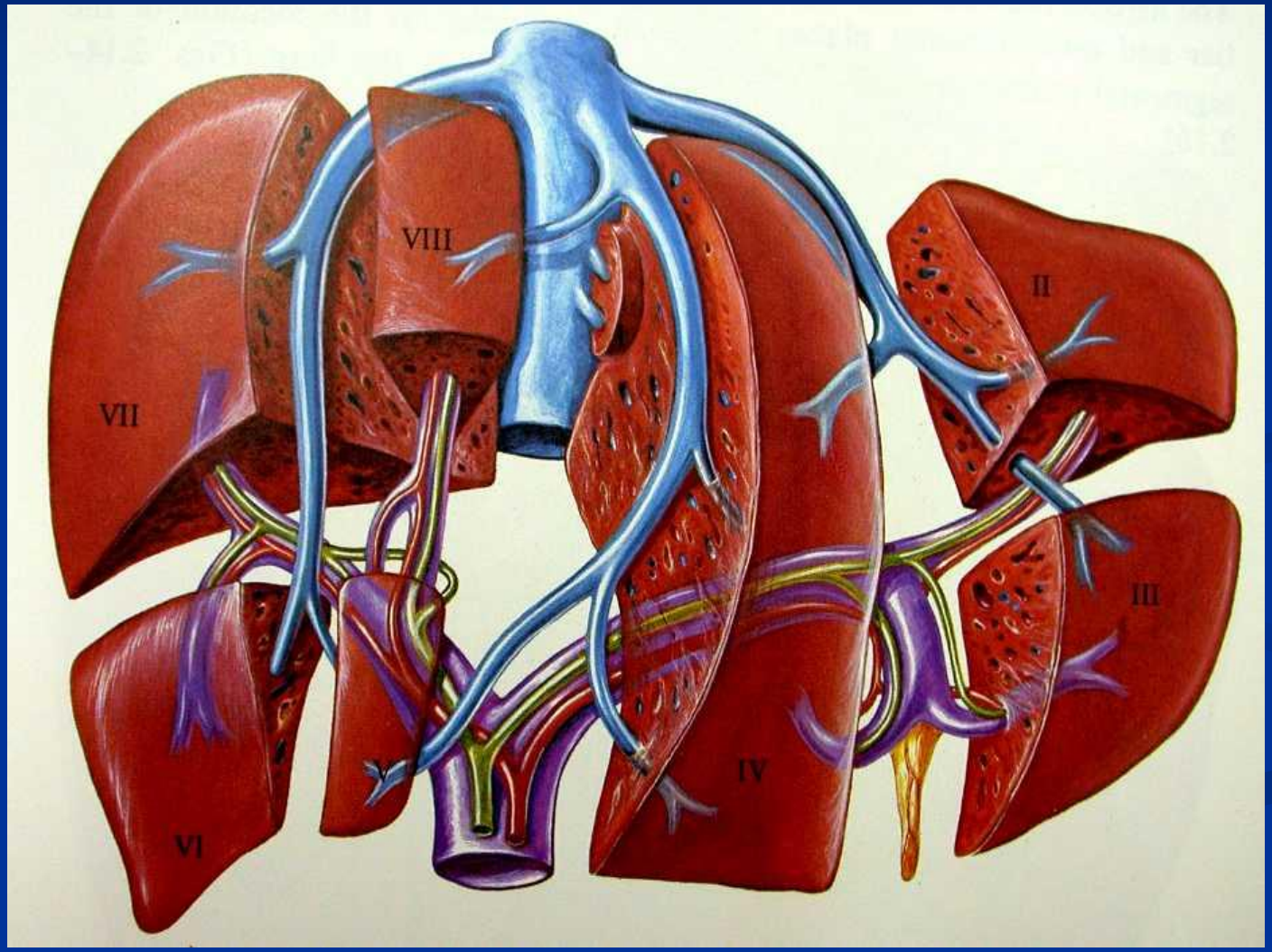

Synchronous anterior resection and microwave ablation of liver lesion

Developed a liver abscess 14 days after the procedure

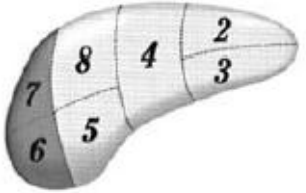
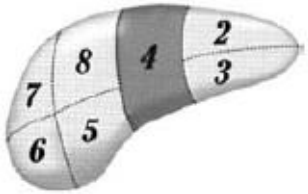
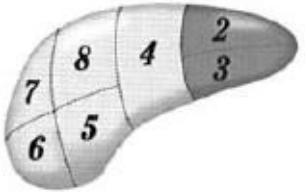
Managed with percutaneous drainage



Hepatic anatomy and nomenclature of resections

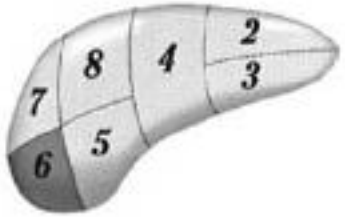


Anatomical Term	Couinaud segments referred to	Term for surgical resection	Diagram (pertinent area is shaded)
Right Hemiliver **OR** *Right Liver*	*Sg 5-8(+/-Sg1)*	*Right Hepatectomy* **OR** *Right Hemihepatectomy* (stipulate +/-segment 1)	
Left Hemiliver **OR** *Left Liver*	*Sg 2-4 (+/-Sg1)*	*Left Hepatectomy* **OR** *Left Hemihepatectomy* (stipulate +/-segment 1)	

Anatomical Term	Couinaud segments referred to	Term for surgical resection	Diagram (pertinent area is shaded)
Right Anterior Section	*Sg 5,8*	Add (-ectomy)to any of the anatomical terms as in *Right anterior sectionectomy*	
Right Posterior Section	*Sg 6,7*	*Right posterior sectionectomy*	
Left Medial Section	*Sg 4*	*Left medial sectionectomy* **OR** *Resection segment 4* (also see Third order) **OR** *Segmentectomy 4* (also see Third order)	
Left Lateral Section	*Sg 2,3*	*Left lateral sectionectomy* **OR** *Bisegmentectomy 2,3* (also see Third order)	

Sg 4-8 *(+/-Sg1)*	*Right Trisectionectomy* *(preferred term)* **or** *Extended Right Hepatectomy* **or** *Extended Right Hemihepatectomy* (stipulate +/-segment 1)	
Sg 2,3,4,5,8 *(+/-Sg1)*	*Left Trisectionectomy* *(preferred term)* **or** *Extended Left Hepatectomy* **or** *Extended Left Hemihepatectomy* (stipulate +/-segment 1)	

Border or watershed: The borders or watersheds of the sections are planes referred to as the *right and left intersectional planes.* The left intersectional plane passes through the umbilical fissure and the attachment of the falciform ligament. There is no surface marking of the right intersectional plane.

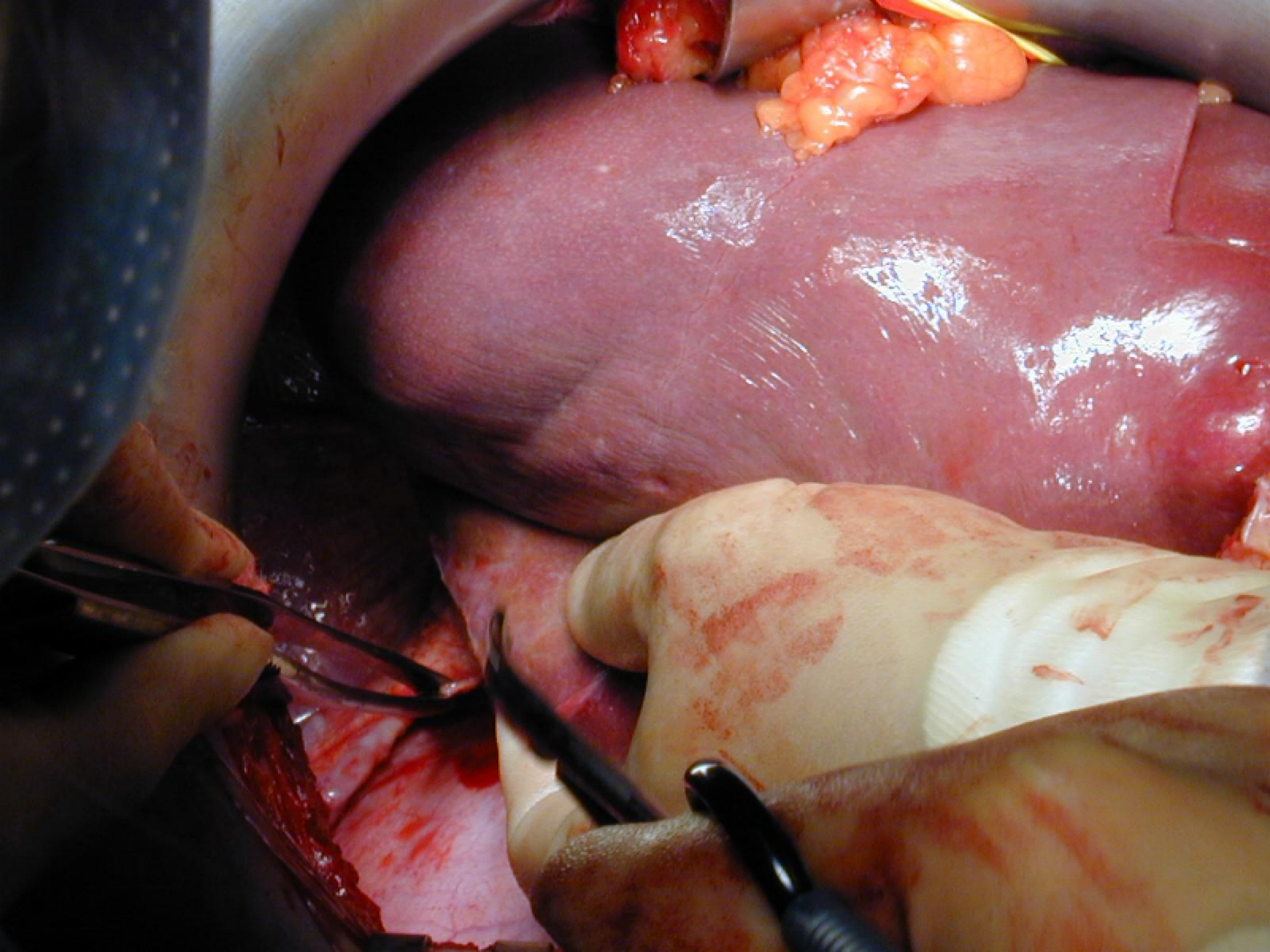
Anatomical Term	Couinaud segments referred to	Term for surgical resection	Diagram (pertinent area is shaded)
Segments 1-9	*Any one of Sg 1 to 9*	*Segmentectomy* (e.g. segmentectomy 6)	
2 contiguous segments	*Any two of Sg 1 to Sg 9 in continuity*	*Bisegmentectomy* (e.g. bisegmentectomy 5,6)	

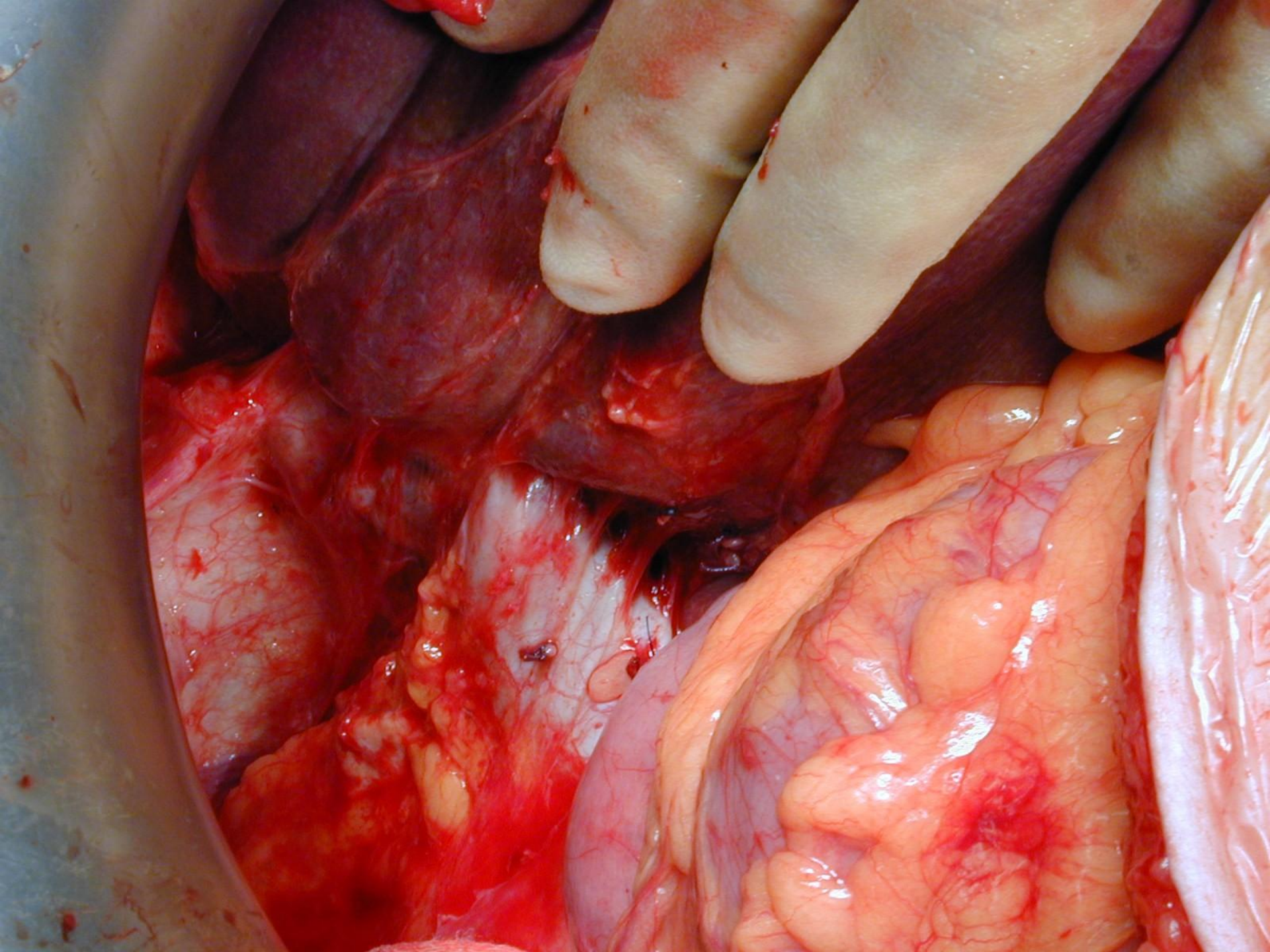
For clarity Sg. 1 and 9 are not shown. It is also acceptable to refer to ANY resection by its third-order segments, eg. right hemihepatectomy can also be called resection sg 5-8.

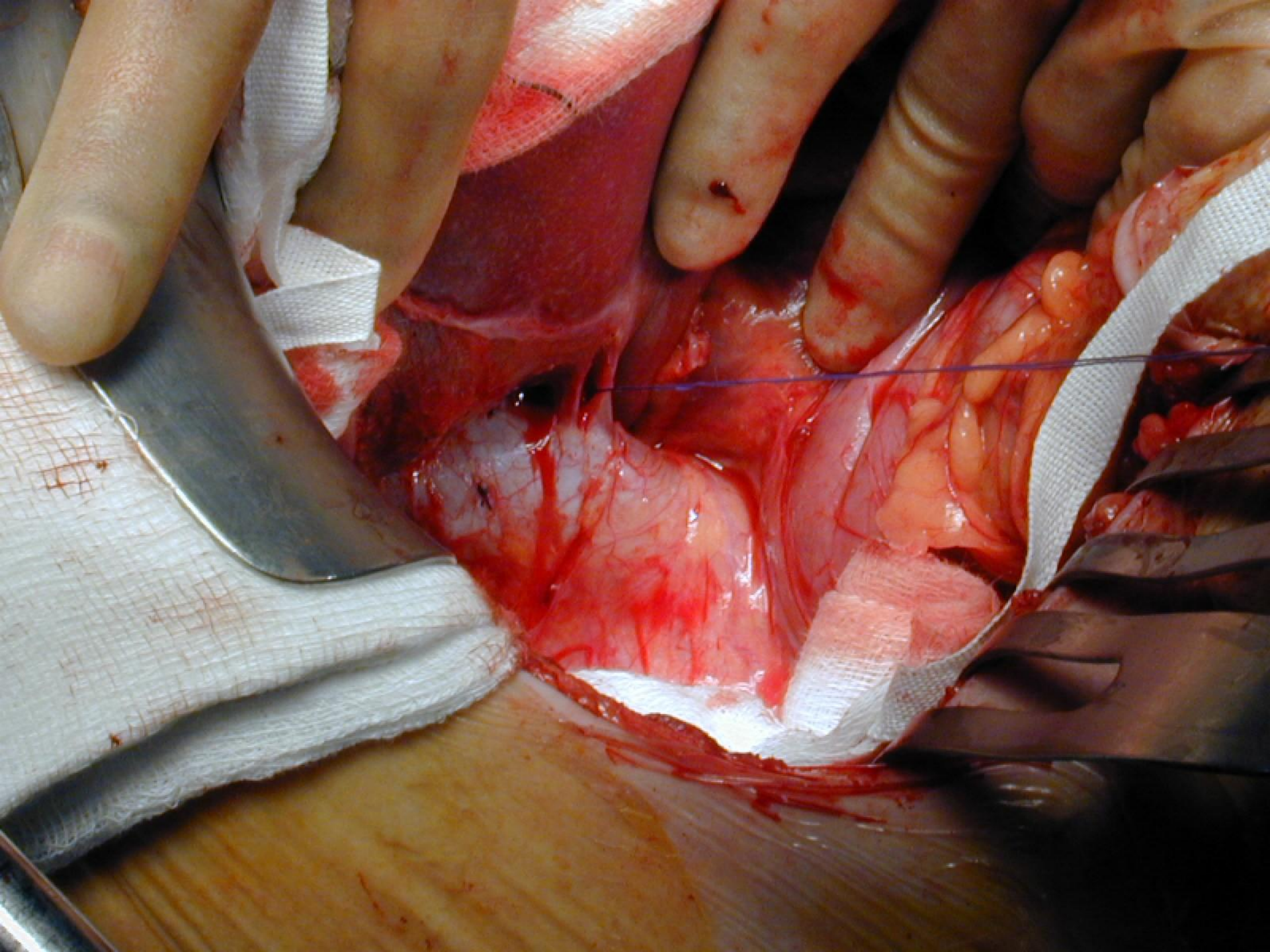
Border or watersheds: The borders or watersheds of the segments are planes referred to as intersegmental planes.

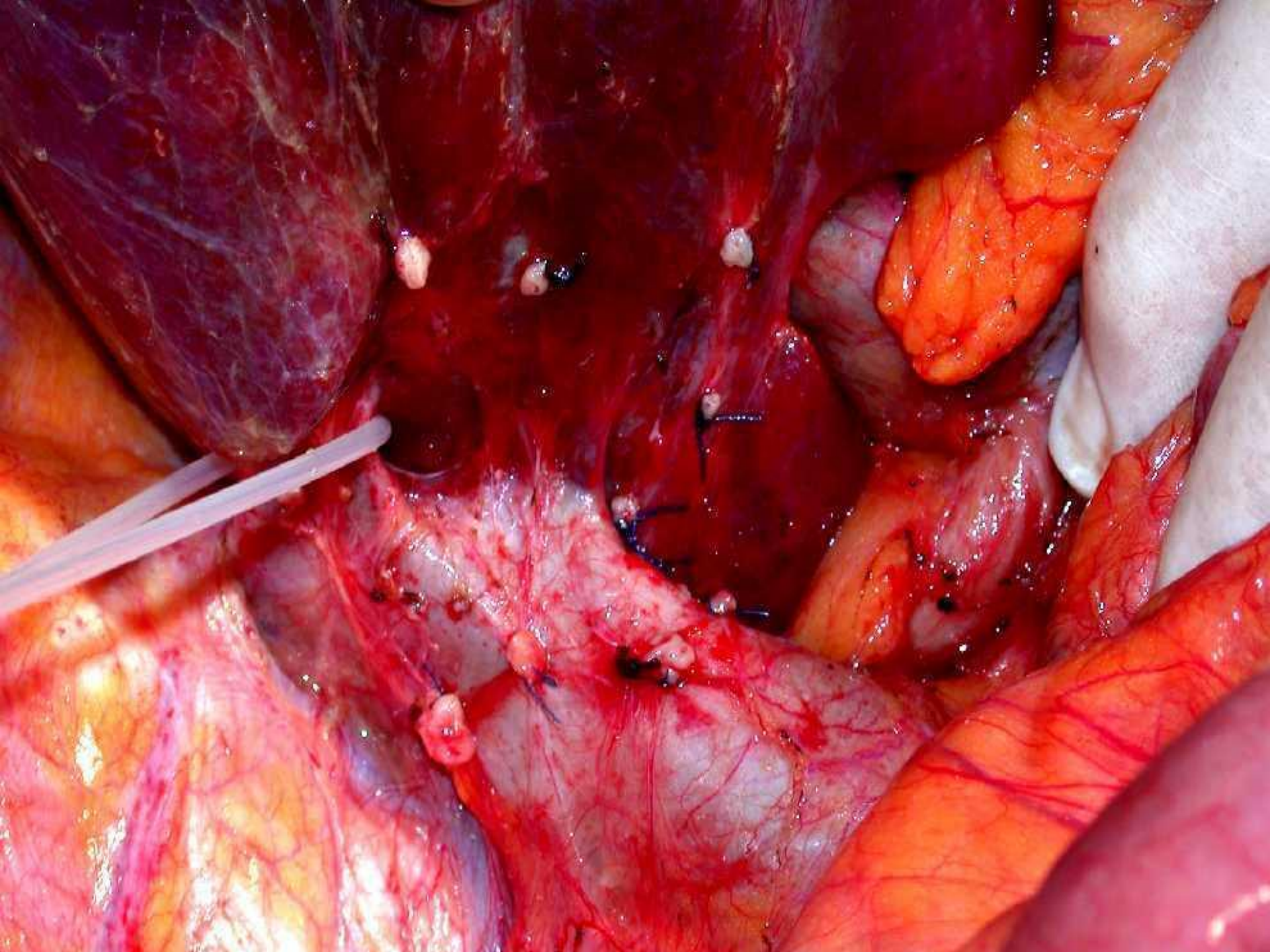
Technique
Basic steps in liver resection

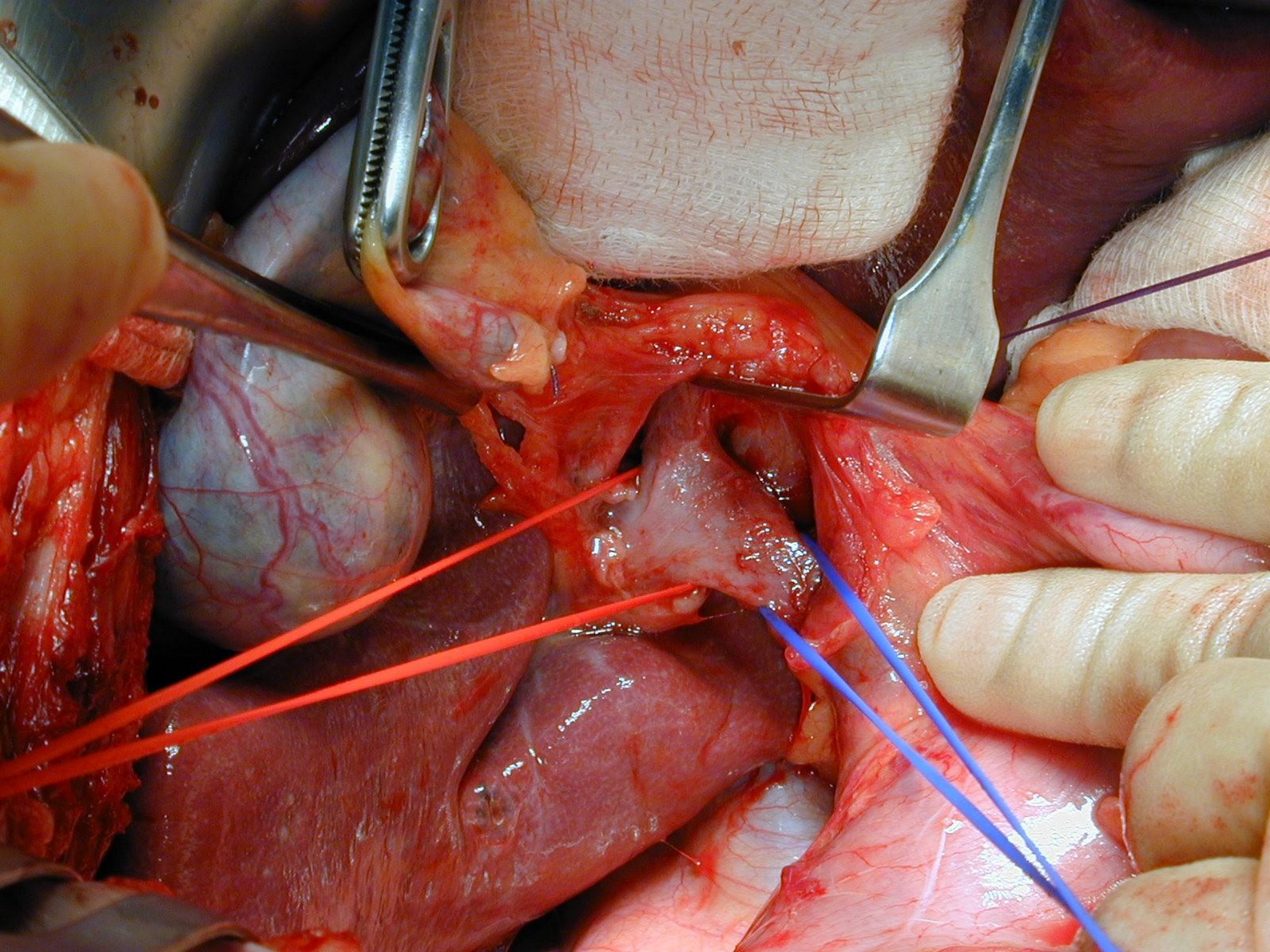
- Exposure/Mobilise liver
- Intra-operative assessment (including intra-operative ultrasound)
- Vascular control
- Parenchymal transection
- Seal cut surface/haemostasis

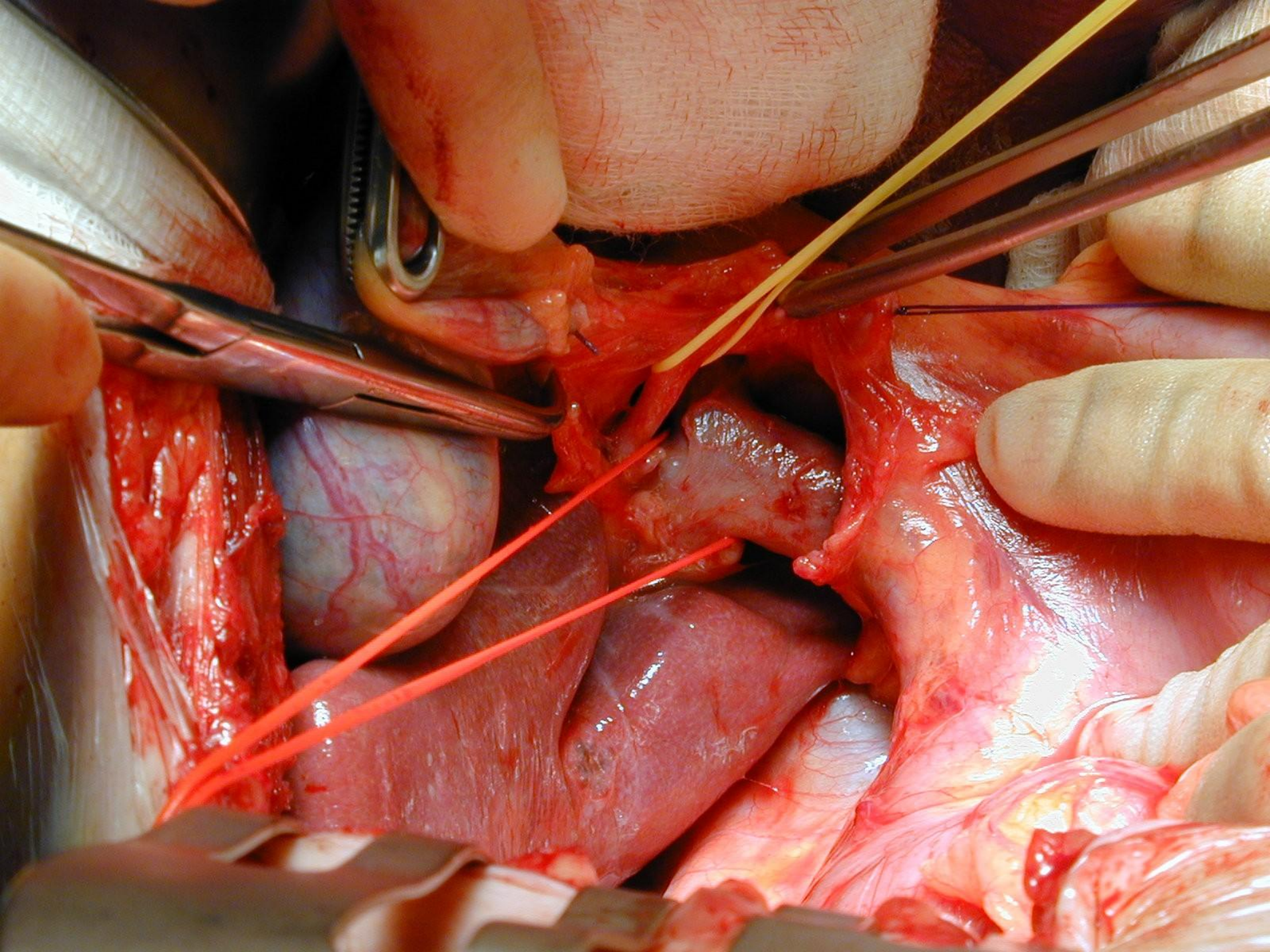


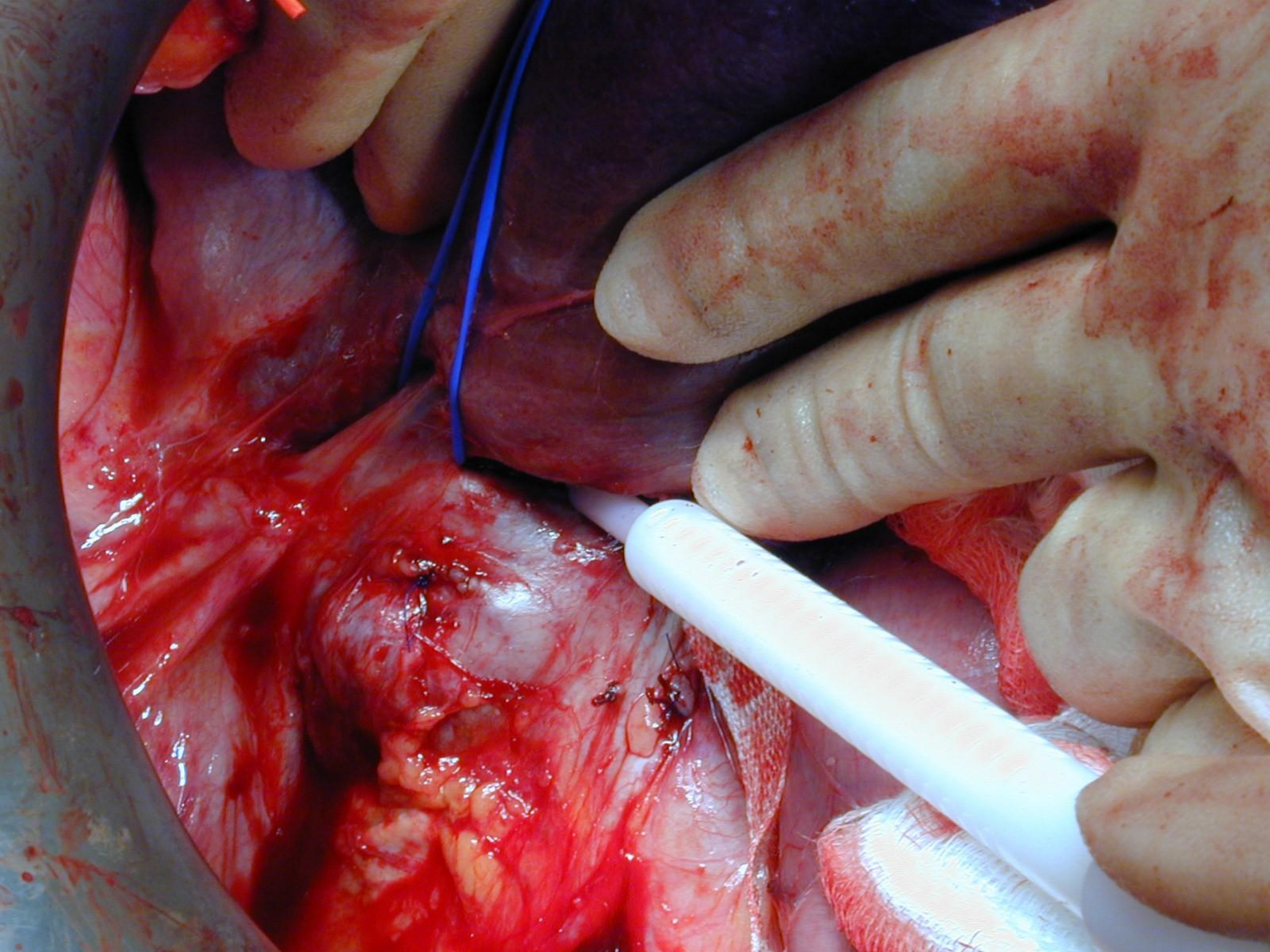




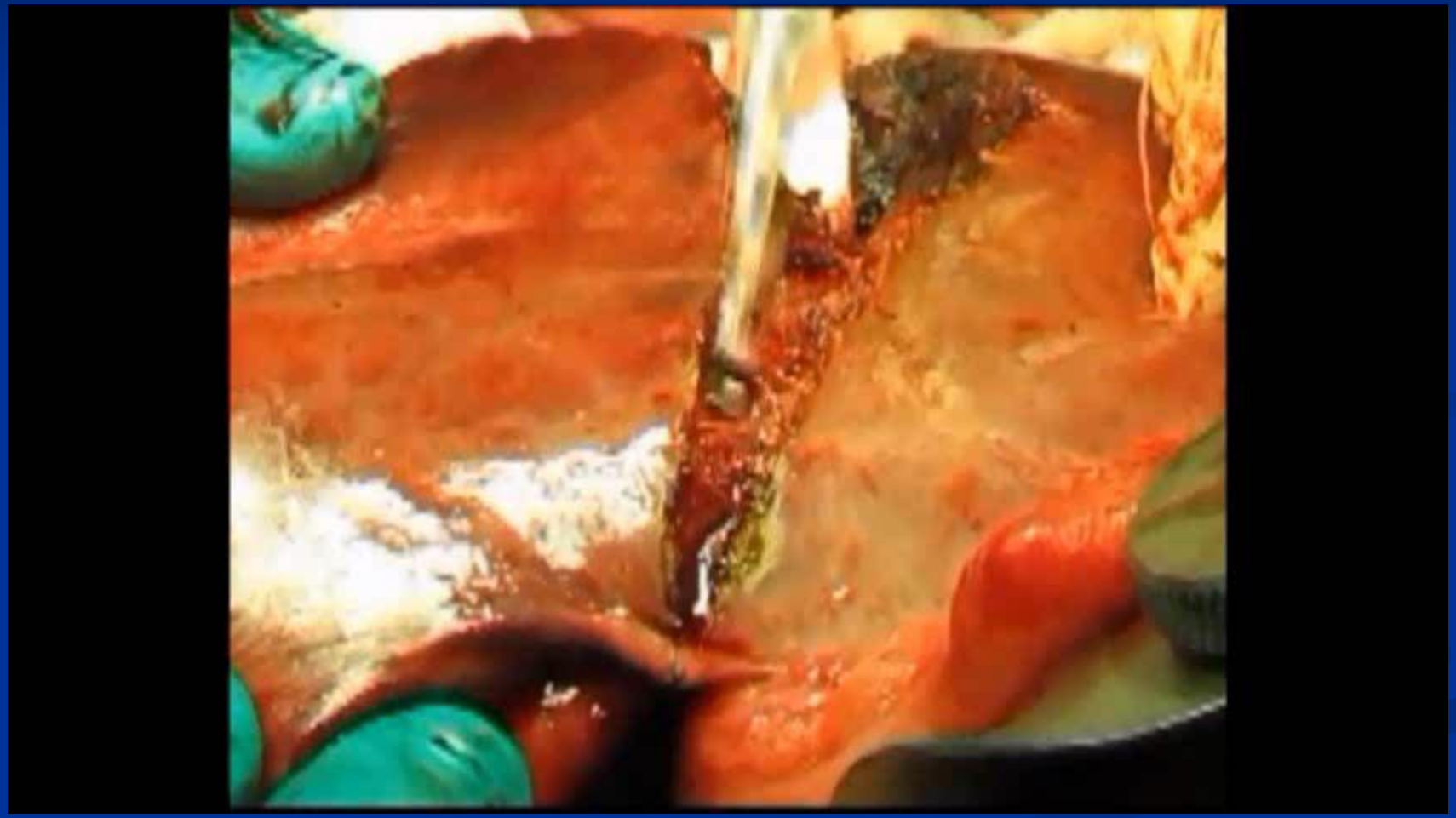




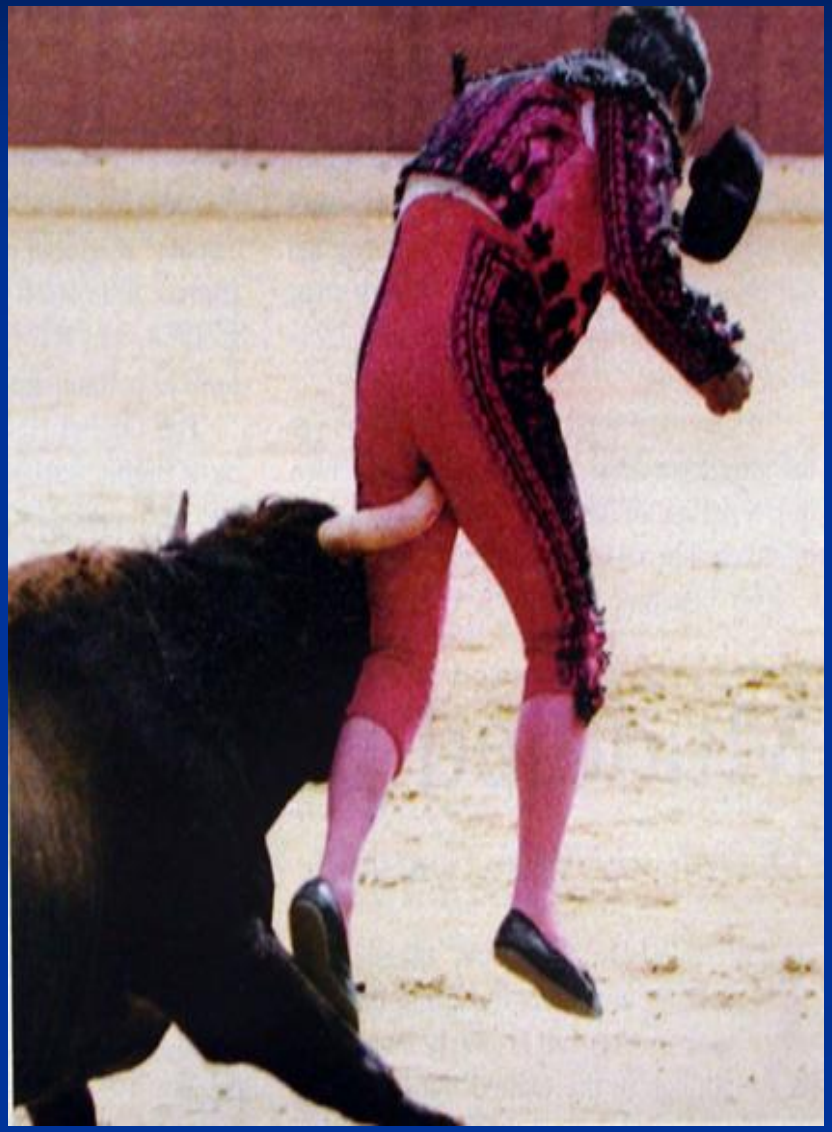




Parenchymal Transection



How to stay out of trouble



- Minimise blood loss
- Avoid prolonged ischaemia
- Resect tumour with adequate margin
- Preserve sufficient functional residual liver

GSH + UCT PAH - HPB unit

All liver resections entered on a prospective data base which includes 1º and 2º pathology, operative details, blood loss, transfusion requirements, complications, survival, etc

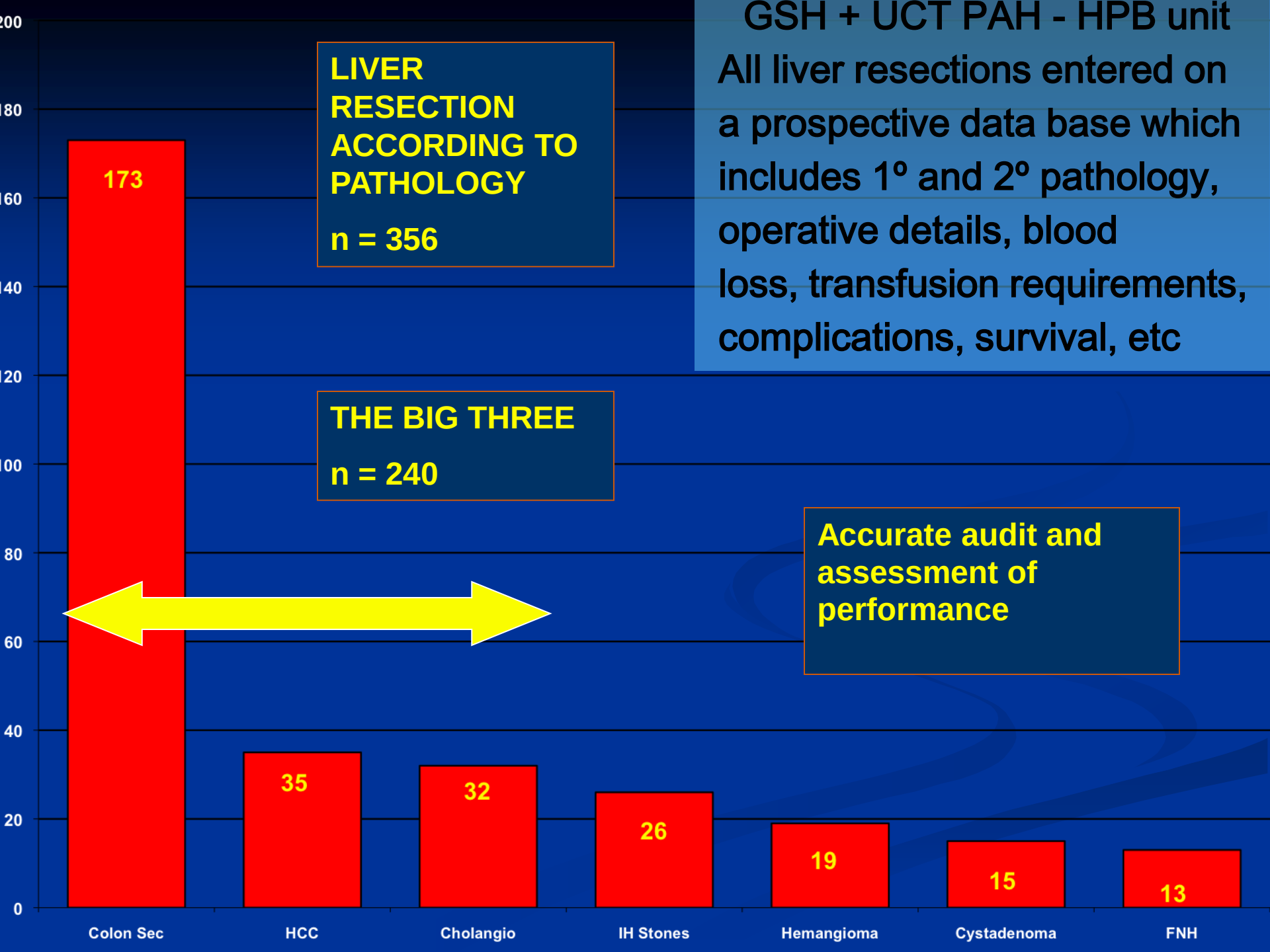
LIVER RESECTION ACCORDING TO PATHOLOGY

n = 356

THE BIG THREE

n = 240

Accurate audit and assessment of performance



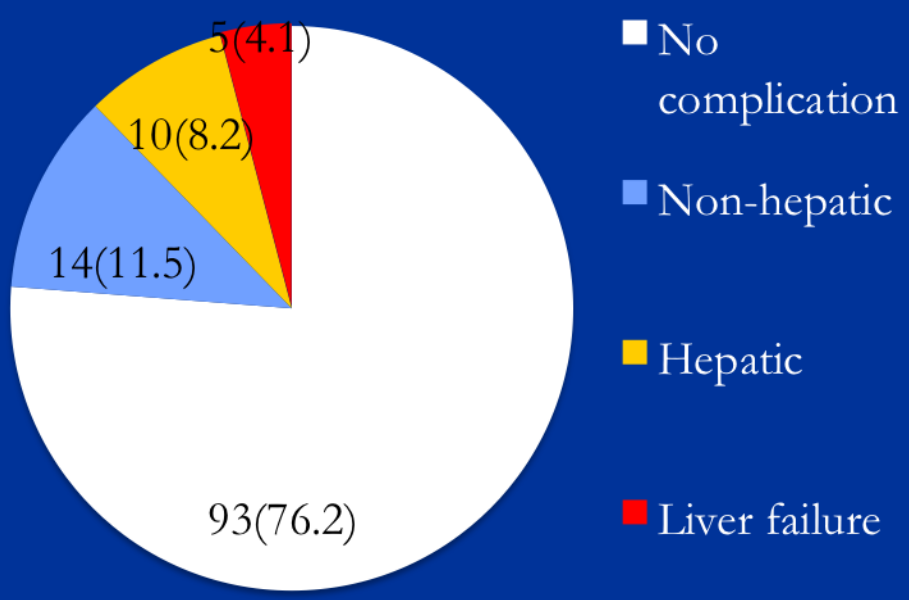
Complications

- Series of 173 patients at Groote Schuur
- Peri-operative mortality – 2.9%
- Major Morbidity -19%
  - Bile leak
  - Subphrenic/perihepatic collection
  - Bleeding requiring re-laparotomy
  - Liver failure – all patients had extended resections

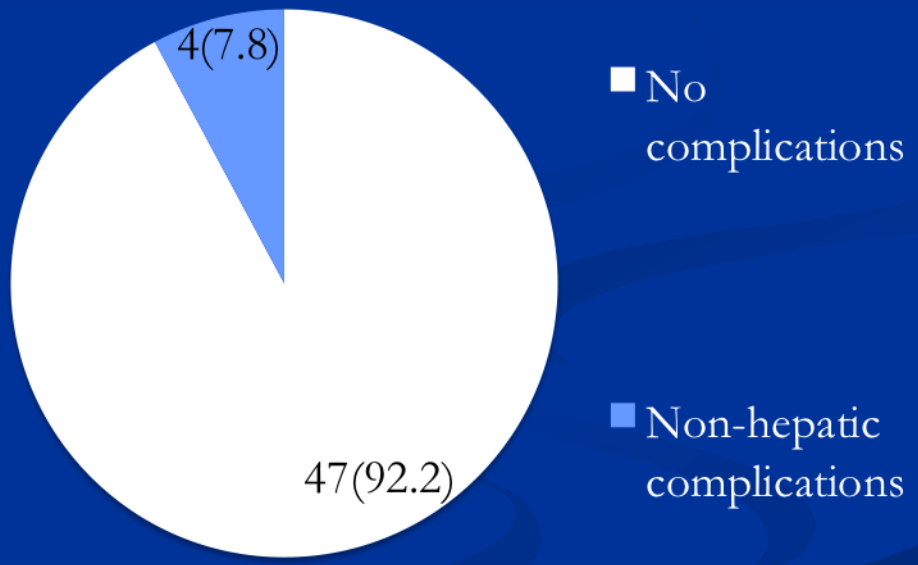
Complications
Major vs. Minor Resections (%)

Major Resections

122/173 (70.9)



Minor Resections 51/173(29.5)



Conclusion

- Liver resection for colorectal liver metastasis prolongs survival and is the only treatment associated with long term survival
- A multimodality approach offers the best results and patients should be discussed in multi disciplinary team meeting
- Complex procedures best carried out in high volume centers with the appropriate expertise