Laparoscopic Liver Surgery

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Disclosure

Medtronic Covidien unresticted grant ORANGE II trial

Advisory consultant TachoSil - Takeda

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REVIEW

World Review of Laparoscopic Liver Resection—2,804 Patients

Kevin Tri Nguyen, MD, PhD, T. Clark Gamblin, MD, MS, and David A. Geller, MD

- Wedge resections
- Segmentectomies
- Left lateral sectionectomies
- Posterior sectionectomies
- Right & left hemi hepatectomies
- Extended right & left hepatectomies
- Bile duct reconstructions

Nguyen et al. Ann Surg 2009

- Living donor hepatectomies

Cherqui et al. Lancet 2002

Cherqui, O'Rourke, Lesurtel, Gayet, Gigot, Gagner, Descottes, Topal, Dagher, Buell, Edwin and others

Outcomes of LLR consistently better

- Less bloodloss
- Less pain
- Less complications
- Mortality and recurrence comparable
- Shorter LOS
- Better survival

- Theatre times considerably longer in major hepatectomy

> 150 series, > 7000 liver resections

RCT not feasible!

Stated in almost every publication on laparoscopic liver resection

Laparoscopy Decreases Pulmonary Complications in Patients Undergoing Major Liver Resection

A Propensity Score Analysis

David Fuks, MD, PhD,† François Cauchy, MD, PhD,‡§¶|| Samir Ftériche, MD,¶|| Takeo Nomi, MD, PhD,*† Lilian Schwarz, MD,‡§ Safi Dokmak, MD,¶|| Olivier Scatton, MD, PhD,‡§ Grazia Fusco, MD,‡§ Jacques Belghiti, MD,¶|| Brice Gayet, MD, PhD,*† and Olivier Soubrane, MD‡§¶||*

	Laparoscopic Major Liver Resection (n = 83)	Open Major Liver Resection (n = 83)	*P*
Overall pulmonary complications, n (%)	12 (14.5)	27 (32.5)	0.006
Pulmonary infection, n (%)	3 (3.6)	7 (8.4)	0.192
Symptomatic pleural effusion, n (%)	9 (10.8)	21 (25.3)	0.016
Pleural effusion requiring drainage, n (%)	2 (2.4)	9 (10.8)	0.029
Respiratory insufficiency, n (%)	2 (2.4)	9 (10.8)	0.029
Acute respiratory distress syndrome, n (%)	2 (2.4)	8 (9.7)	0.050
Pulmonary embolism, n (%)	0 (0.0)	2 (2.4)	0.155

Fuks, D. et al. *Ann Surg 2015*

Morioka Consensus 2014
Outcomes of LLR consistently better

- Less bloodloss
- Less pain
- Less complications
- Mortality and recurrence comparable
- Shorter LOS
- Better survival

MAJORITY LEVEL 3 EVIDENCE

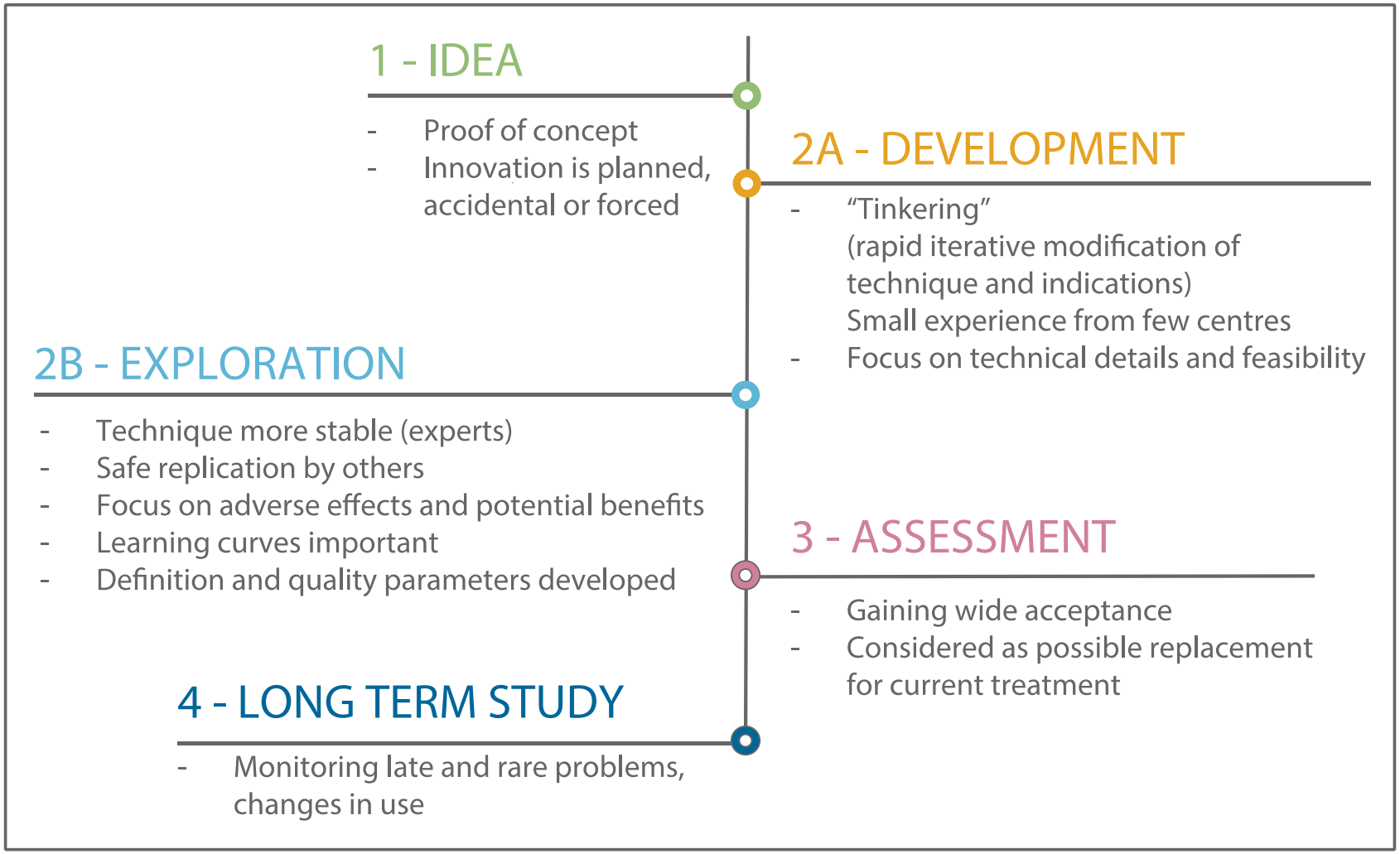
LOW quality by GRADE

- Theatre times considerably longer in major hepatectomy

> 150 series, > 7000 liver resections

IDEAL Framework (Balliol)

Idea, Development, Exploration, Assessment, Long-term follow up



McCulloch et al., Lancet 2009

Morioka LLR Consensus 2014

Minor lap liver resection

IDEAL stage 3
Assessment phase

Major lap liver resection

IDEAL stage 2b
Exploration/learning phase

Wakabayashi, G. et al. *Ann Surg 2015*

Morioka Consensus 2014

Participation in ongoing randomized controlled trials is STRONGLY recommended.

An international registry should be initiated to document the role and safety of LLR.

A/E/A-IHPBA guided training programmes should be established

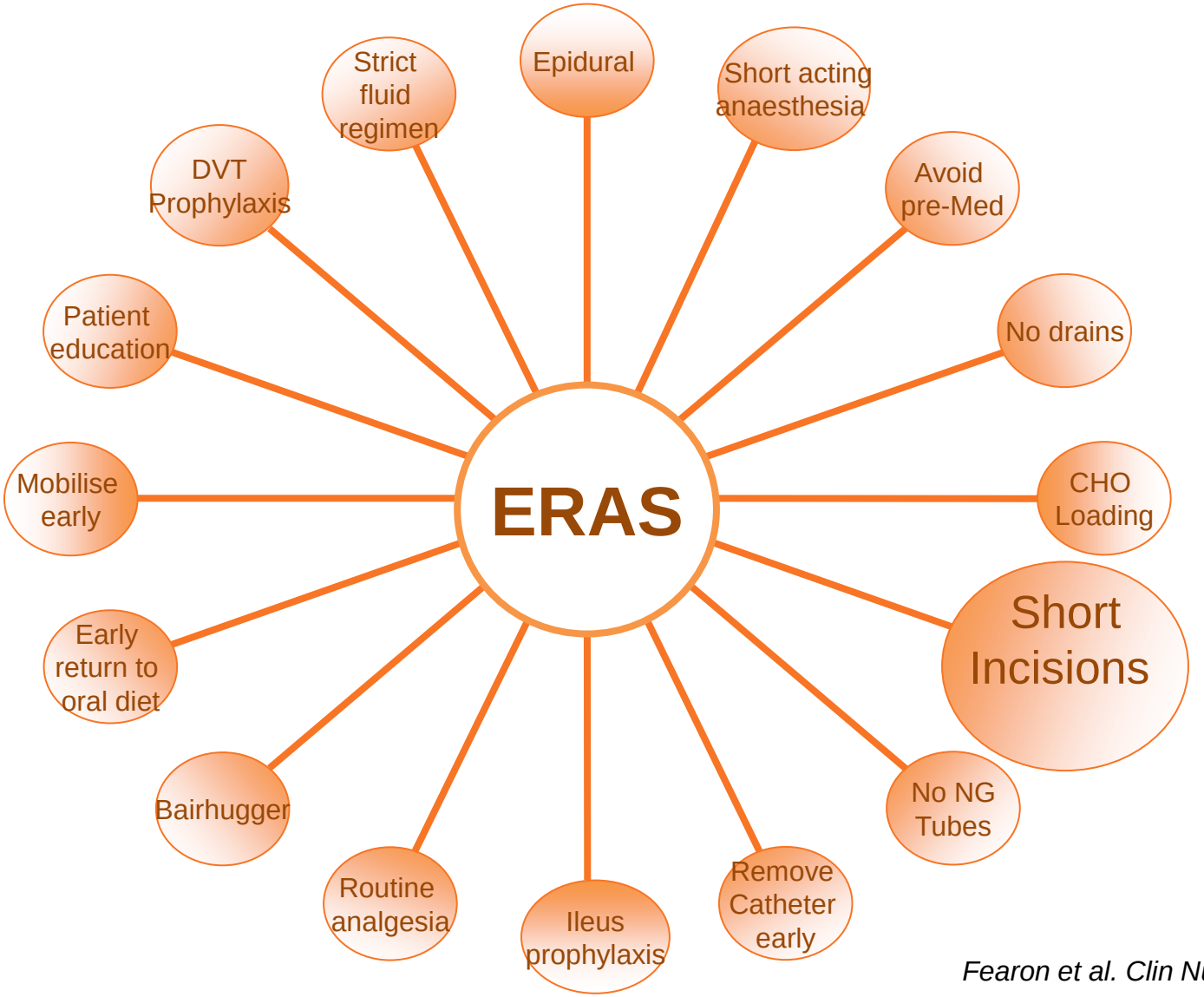
STRONG recommendations

Wakabayashi, G. et al. *Ann Surg 2015*

Liver surgery 2003

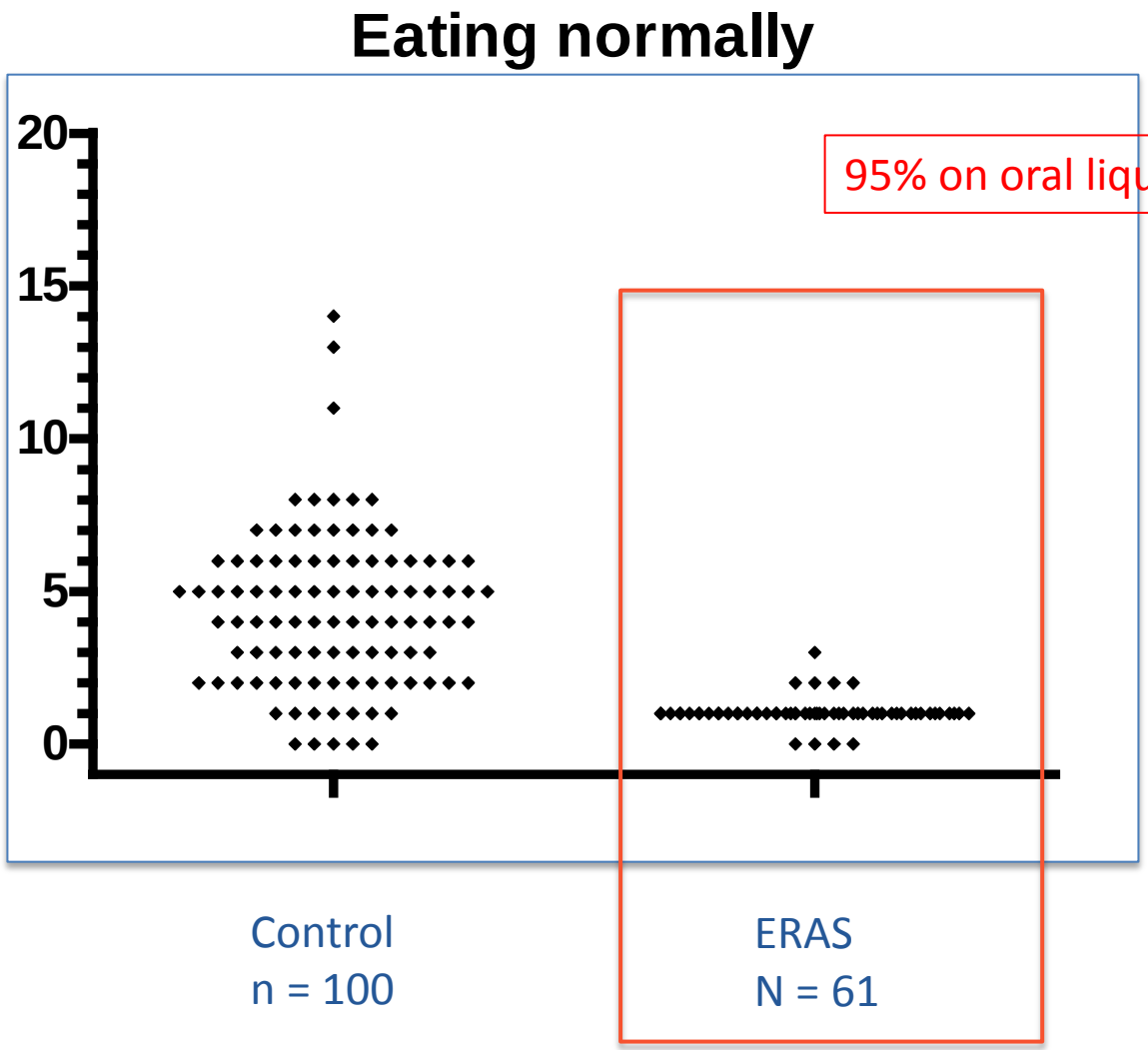
Edinburgh, Tromso and Maastricht

Enhanced recovery in liver surgery



Fearon et al. Clin Nutr 2005

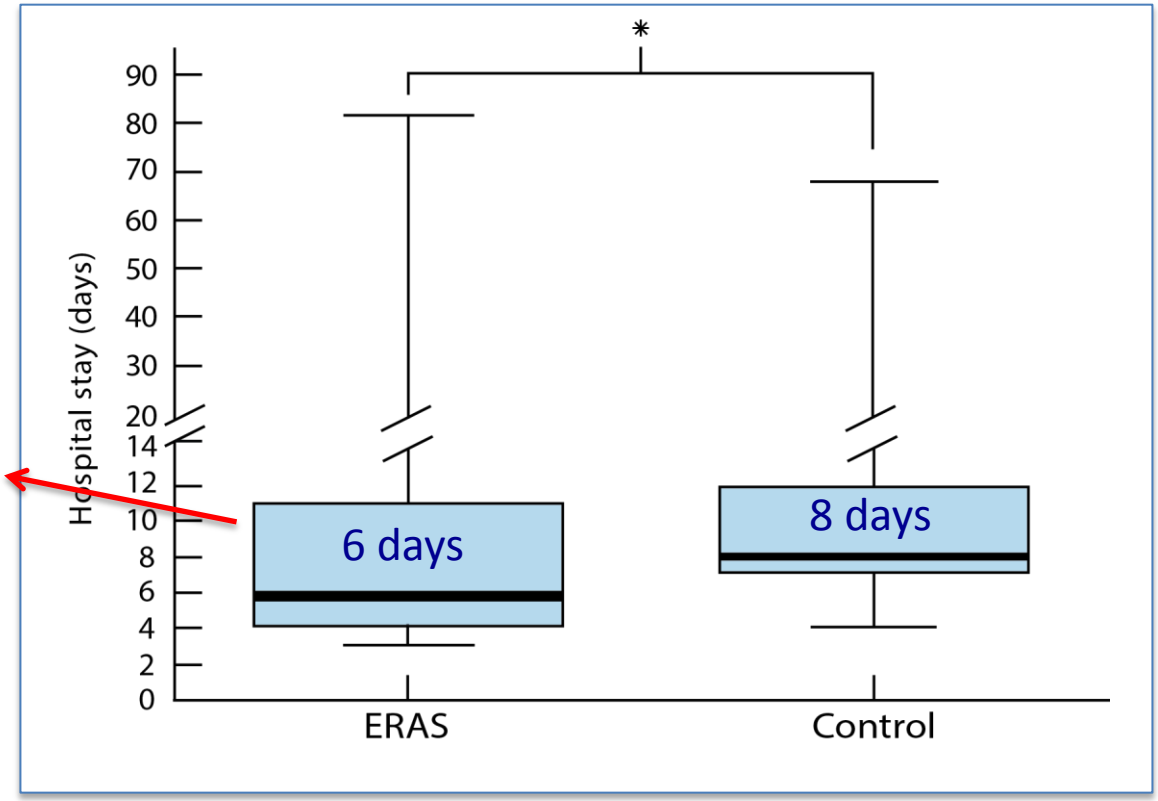
ERAS Liver pilot Maastricht Edinburgh



Van Dam et al. BJS 2008

Median hospital length of stay

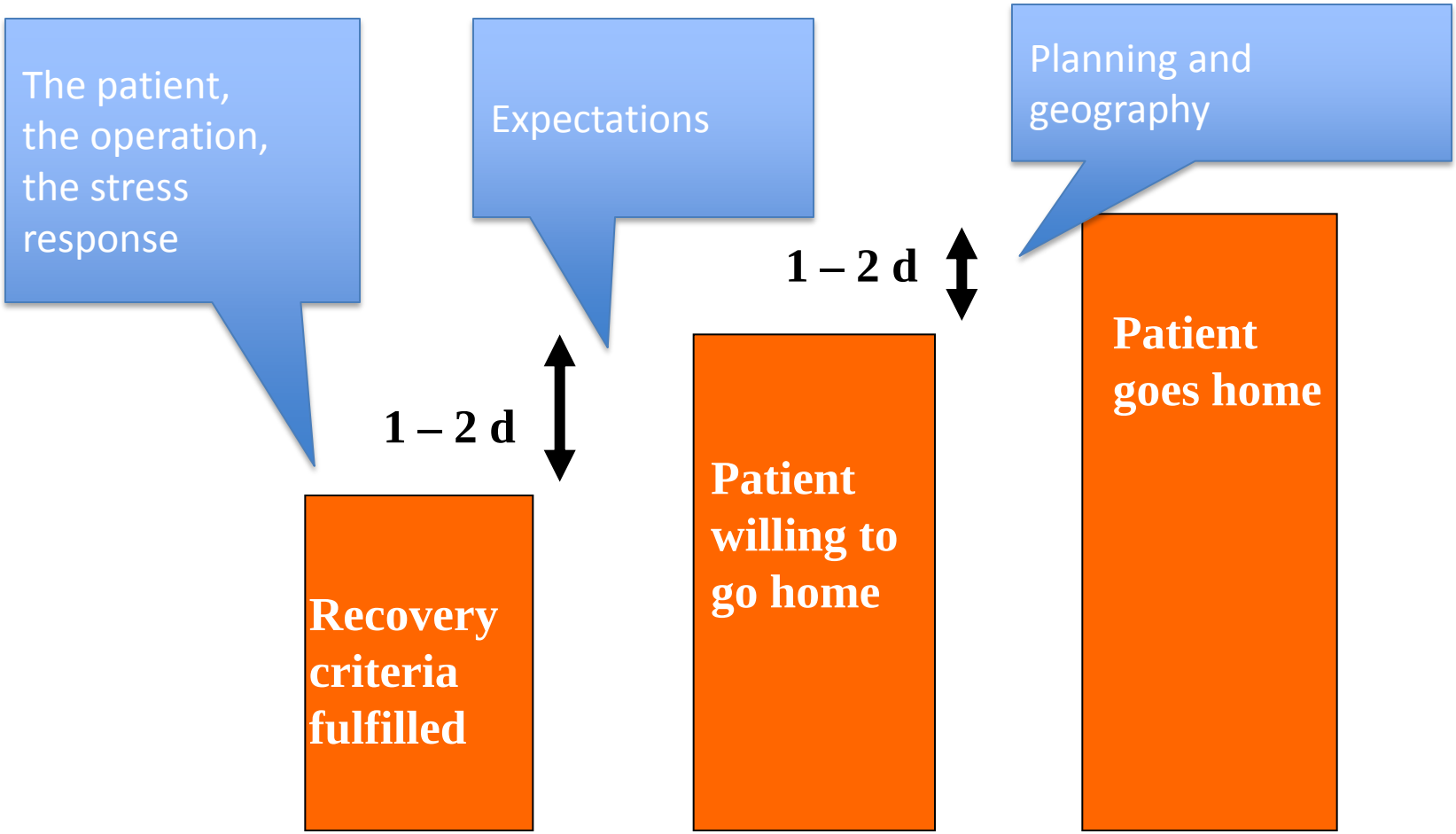
Logistics
Complications



P = 0.002

Van Dam et al. BJS 2008

What determines hospital length of stay?



ERAS-group

Liver resection

Update 2009

ERAS

&

Laparoscopy

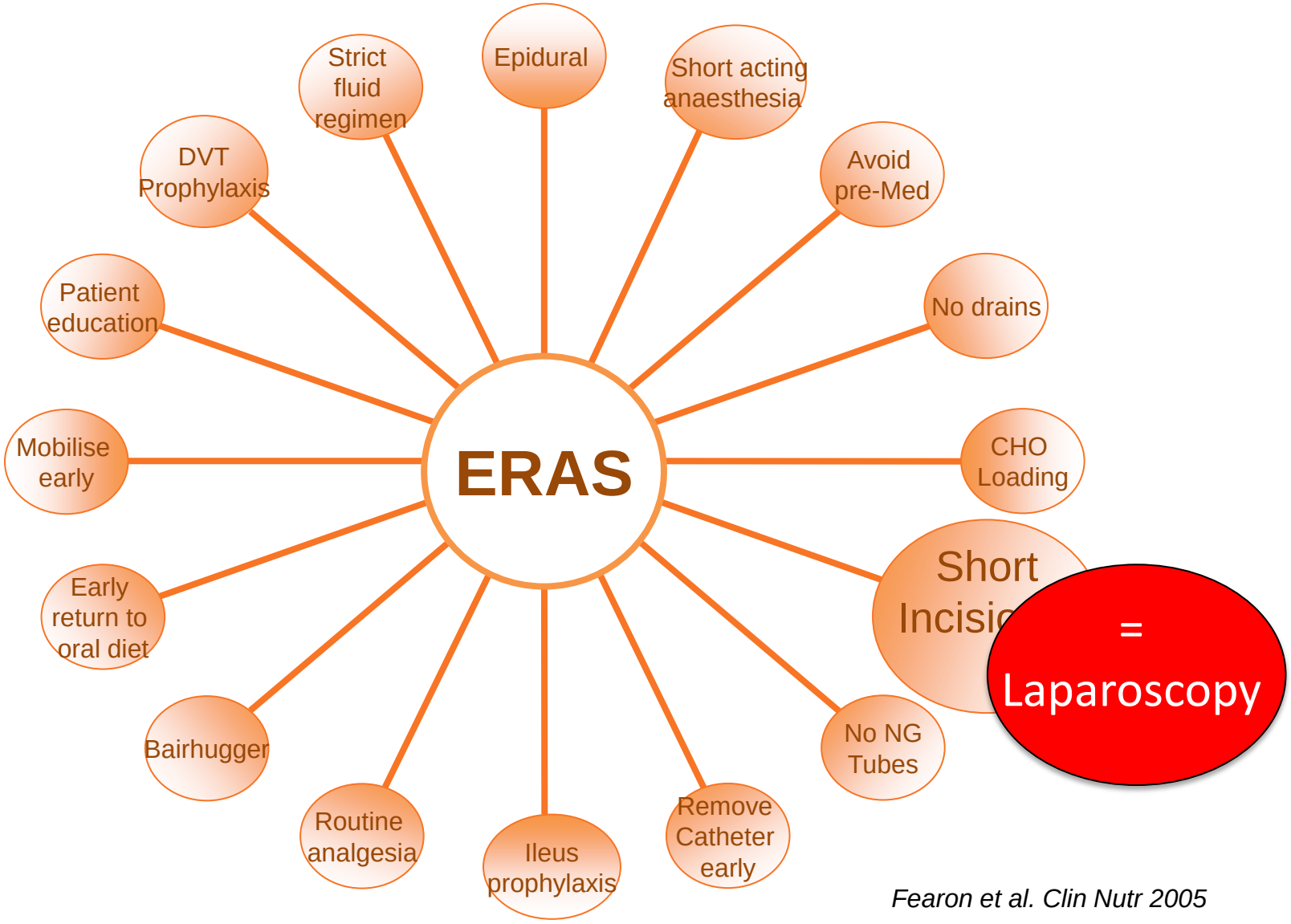
ERAS Liver
Since 2003
< 10 publications

Median LOS 4 days

Laparoscopic liver resection
Since 1995
500 publications

Median LOS 4 days

Enhanced recovery in liver surgery



Fearon et al. Clin Nutr 2005

New objective outcome parameter

Update

Functional recovery

=

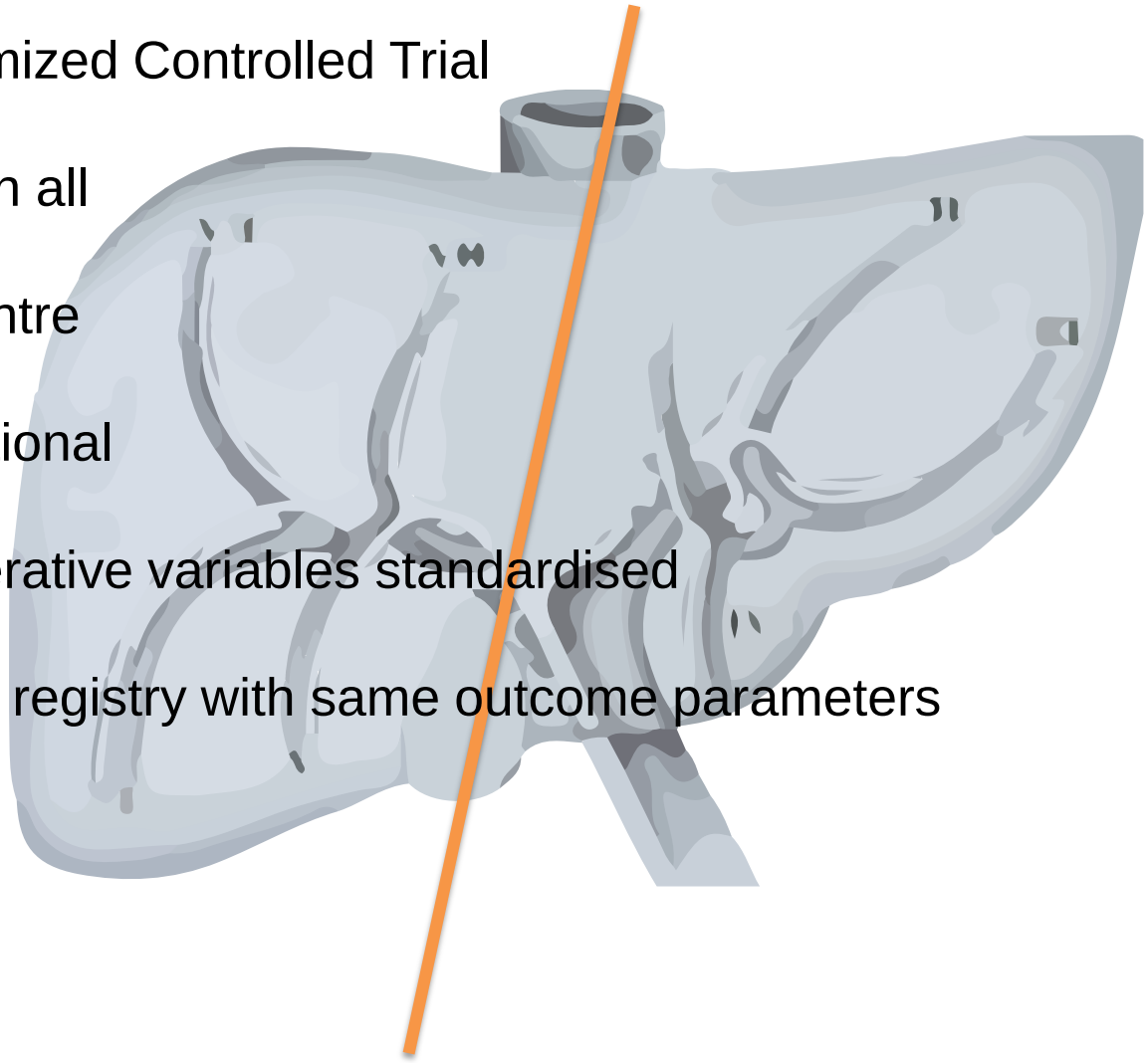
ready for discharge

	Functional Recovery	Discharge
Tolerance of solid food	✔	✔
No IV fluids	✔	✔
Oral analgetics only	✔	✔
Mobile at pre op level	✔	✔
Normal / improving serum bilirubine & INR	✔	✔
	Willing to go home	✔

ORANGE II PLUS RCT

Laparoscopic vs open hemihepatectomy

- Randomized Controlled Trial
- ERAS in all
- Multicentre
- International
- Perioperative variables standardised
- Parallel registry with same outcome parameters



PRIMARY & SECONDARY OUTCOMES

Primary	Secondary
1. Time to functional recovery	1. Total postoperative LOS (readmission < 30 days included)
	2. Intraoperative blood loss
	3. Operation time
	4. Resection margin
	5. Time to adjuvant chemotherapy initiation
	6. Readmission percentage
	7. Total morbidity (Intraoperative incidents and postoperative complications)
	8. Composite of liver specific morbidity
	9. Quality of life
	10. Body image and cosmesis
	11. Reasons for delay of discharge after functional recovery
	12. Long term incidence of incisional hernias
	13. Hospital and societal costs during one year
	14. Overall five-year survival

ORANGE II Plus study group

The Netherlands
- Maastricht University Medical Center
- Academic Medical Center, Amsterdam

Belgium
- Ghent University Hospital
- Jessa Hospital, Hasselt
- Groeninge General Hospital, Kortrijk
- Erasme Hospital, Brussels

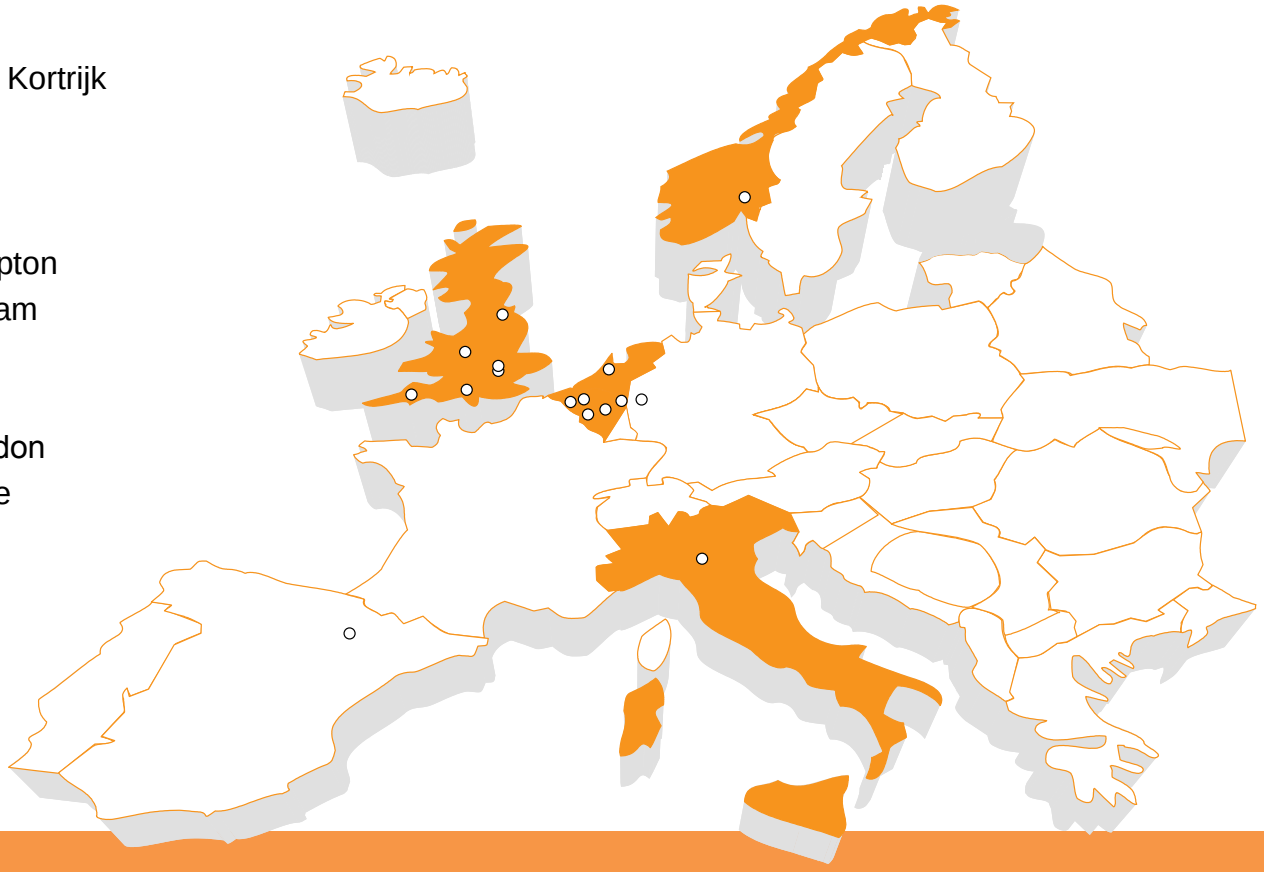
United Kingdom
- University Hospital Southampton
- University Hospital Birmingham
- Derriford Hospital Plymouth
- Royal Free Hospital, London
- King's College Hospital, London
- Freeman Hospital, Newcastle

Italy
- San Raffaele Hospital, Milan

Norway
- Oslo University Hospital

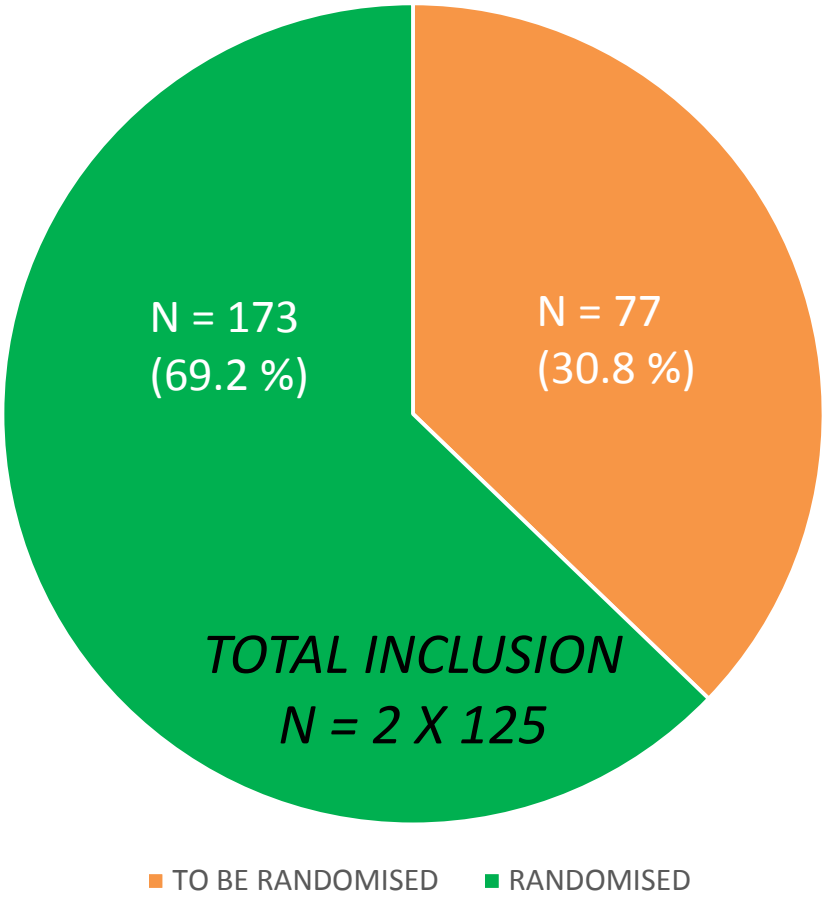
<u>Pending approval</u>

- University Clinic Aachen, Germany
- Royal Brisbane Hospital, Australia



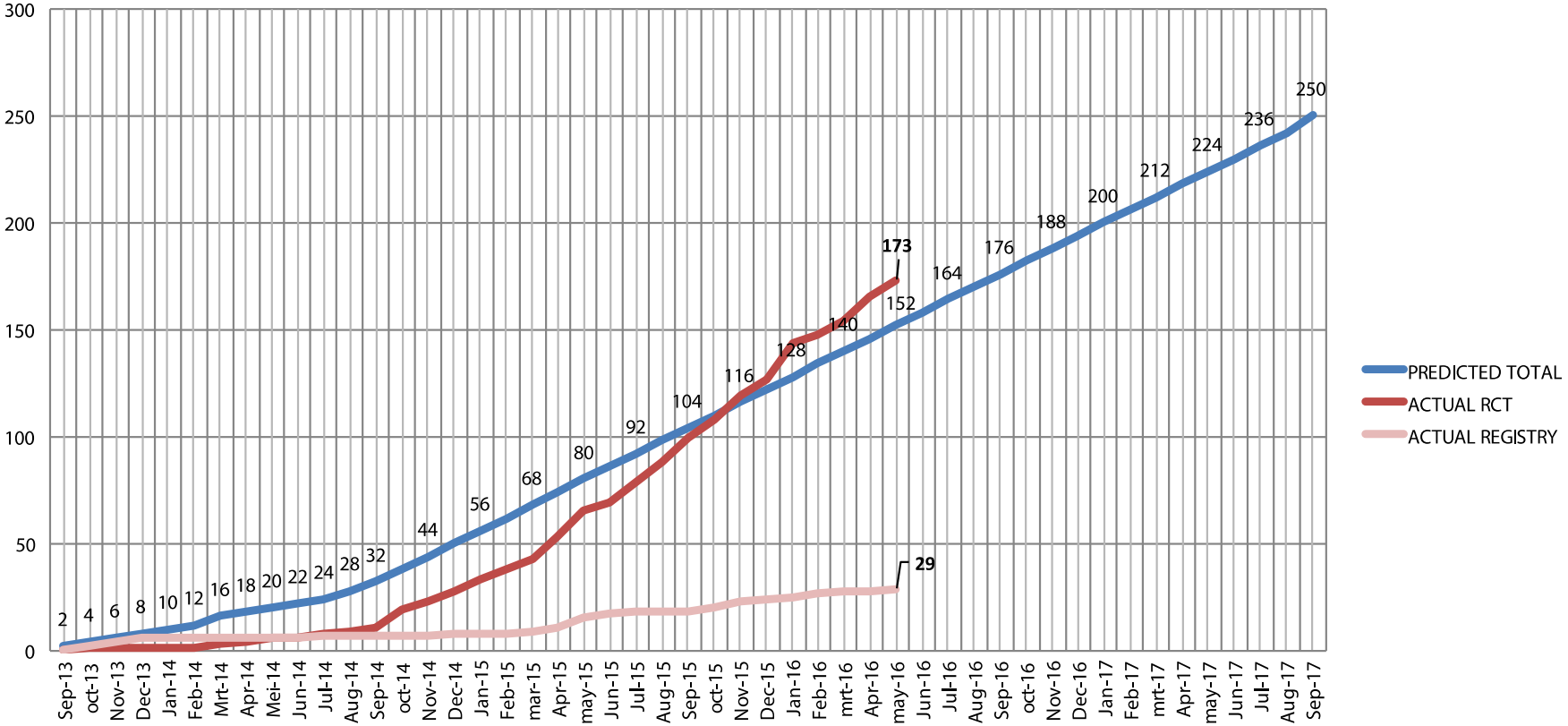
ORANGE II PLUS RCT

CURRENT ACCRUAL



TOTAL TRIAL ACCRUAL

Current randomisations: 173/250 Current registry: 29



Expected closing spring 2017

THE OSLO COMET-STUDY

Finished n=270 randomised!

RANDOMIZED CONTROLLED TRIAL OF OPEN AND LAPAROSCOPIC LIVER RESECTION FOR COLORECTAL METASTASES

Å.A.Fretland, A.M.Kazaryan, K.Flatmark, B.E.Bjørnbeth, T.E.Mollnes,
R. Kristiansen, K. Øyri, B.Edwin

“Technique of laparoscopic liver resection"
Savoir faire

No clear evidence-based techniques

Hilar dissection vs Glissonian approach (EU 60% vs 40 %)

Hibi et al. *Surg Endosc 2015*

“Technique of laparoscopic liver resection"
Savoir faire

30^{o} laparoscopes (+/- robot)

Low CVP

Pneumoperitoneum at 12 mm Hg

Intermittent (selective) hepatic pedicle clamping

Limited to full mobilization of liver

Parenchymal transection - bipolar/ultrasonic dissector / sealer / CUSA

Endoscopic stapler for pedicles

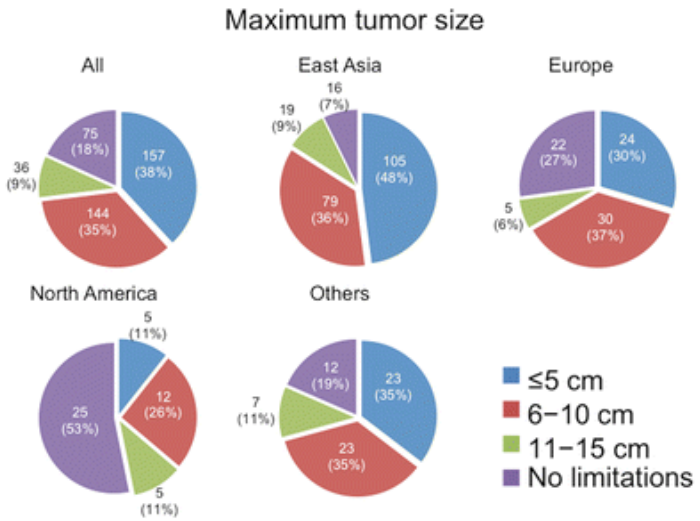
Hem-o-lok / clips for arteries, veins, bileducts

Left lateral sectionectomy

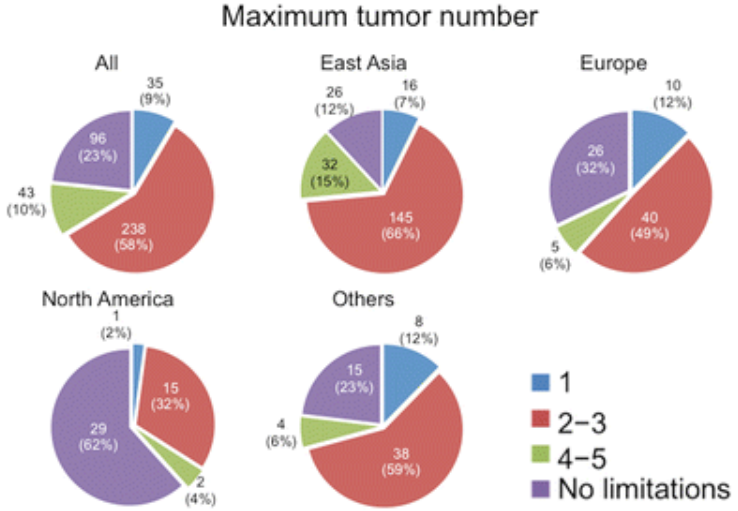
Laparoscopic liver resections

Low complexity	Intermediate complexity	High complexity
Biopsy Little wedge resection	Left lateral sectionectomy Anterior segmentectomy IVb V VI	Left-hemihepatectomy Right hemihepatectomy Posterior Wedge-Segment IVa VII VIII Caudate lobe Trisectionectomy Living donor resections

Tumor size and number in laparoscopic liver



More difficult



More time

Hibi et al. *Surg Endosc 2015*

Conversion
major laparoscopic liver resection

- 30 (13.5%) in 223 patients
- 2 Paris expert centers 2000 - 2013

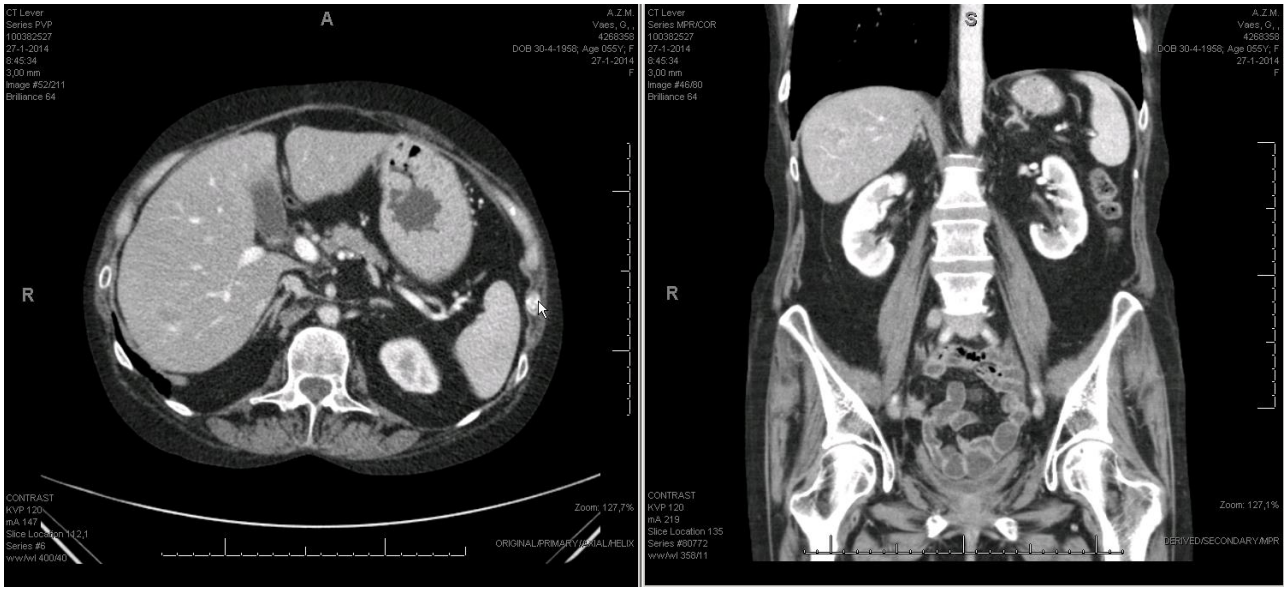
Main reasons: Adhesions, bleeding & failure to progress

Risk factors

- Diabetes
- Age > 75 yrs
- BMI > 28
- Tumor > 10 cm
- Biliary reconstruction

Cauchy, F. et al. *Ann Surg 2015*

Intrahepatic anatomical thinking



Preoperative CT

4 phase contrast enhanced

3D reconstruction

Vessel based route planning

Positioning

right tilt – left decubitis – semi prone

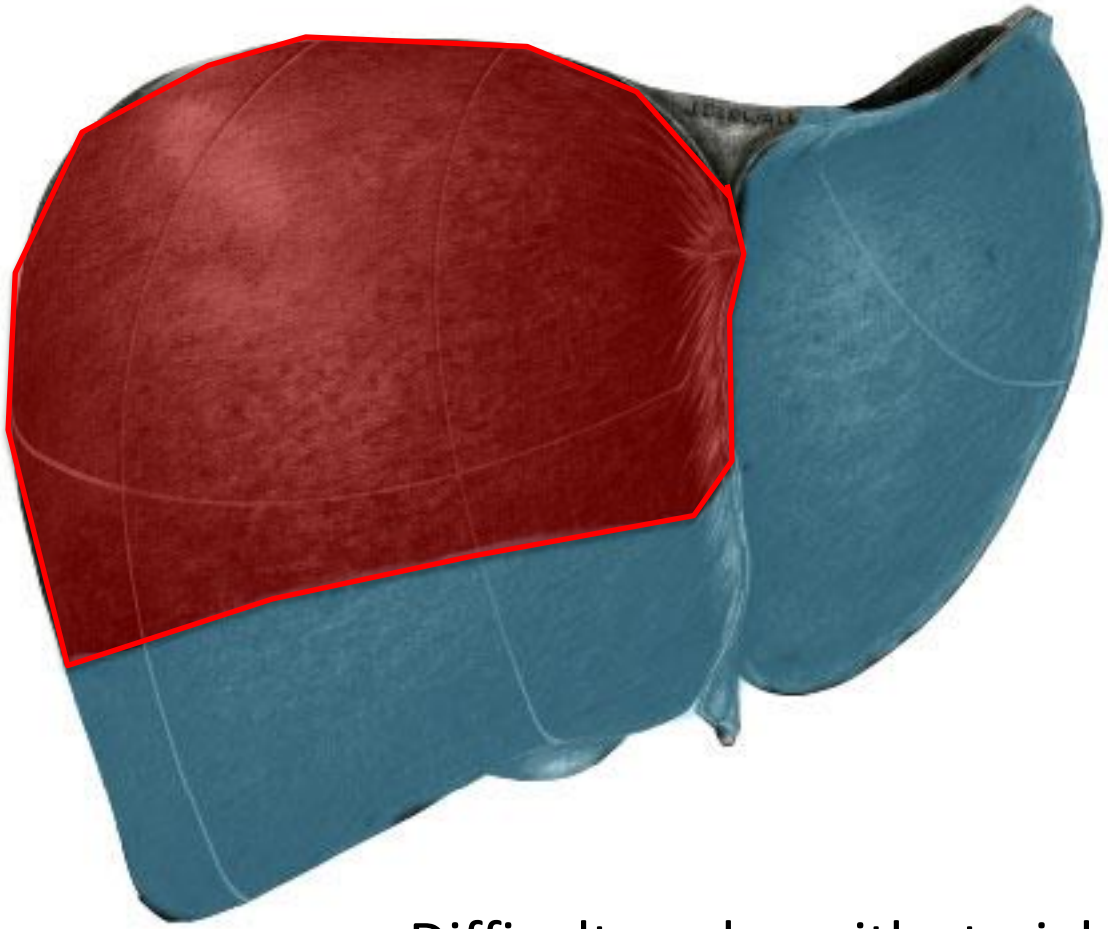
Gravity

Adhesions

Retraction suture

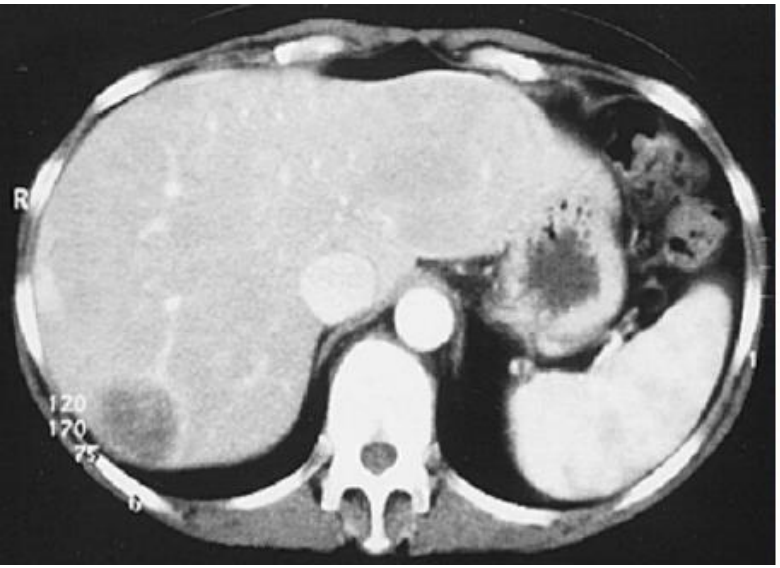
Posterior segments

minor = major!!!



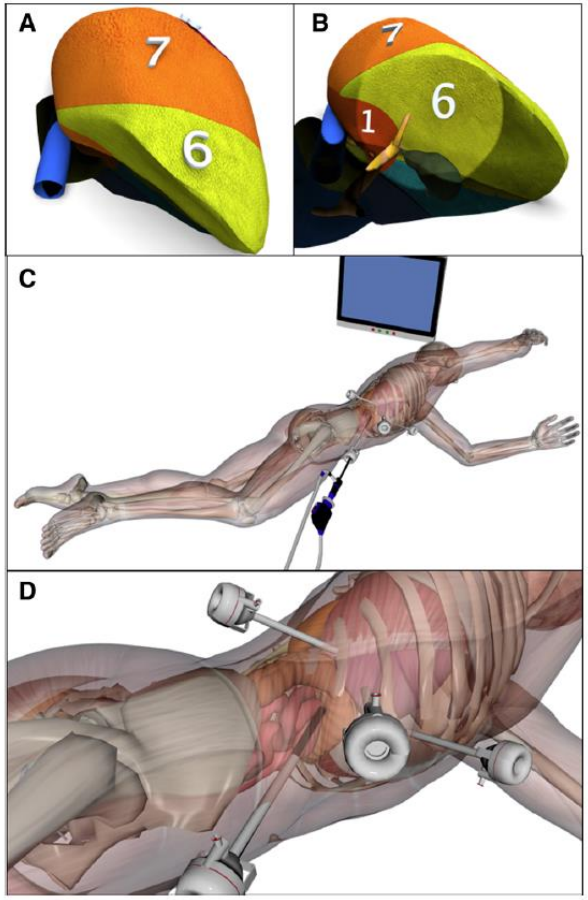
Difficult angles with straight instruments

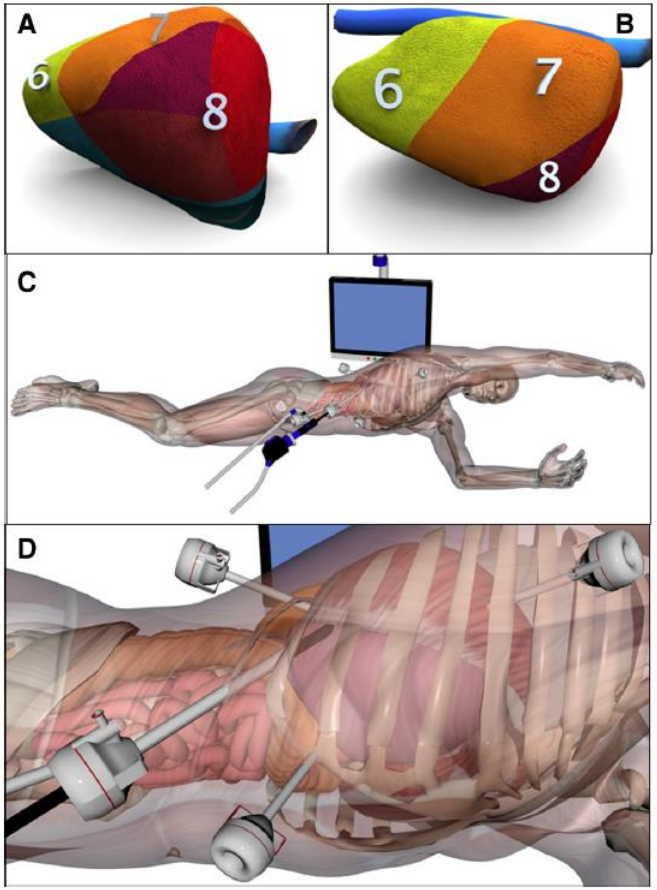
Anterosuperior and posterolateral segments +/- transthoracic



Fuks et al. *Update Surgery 2015*

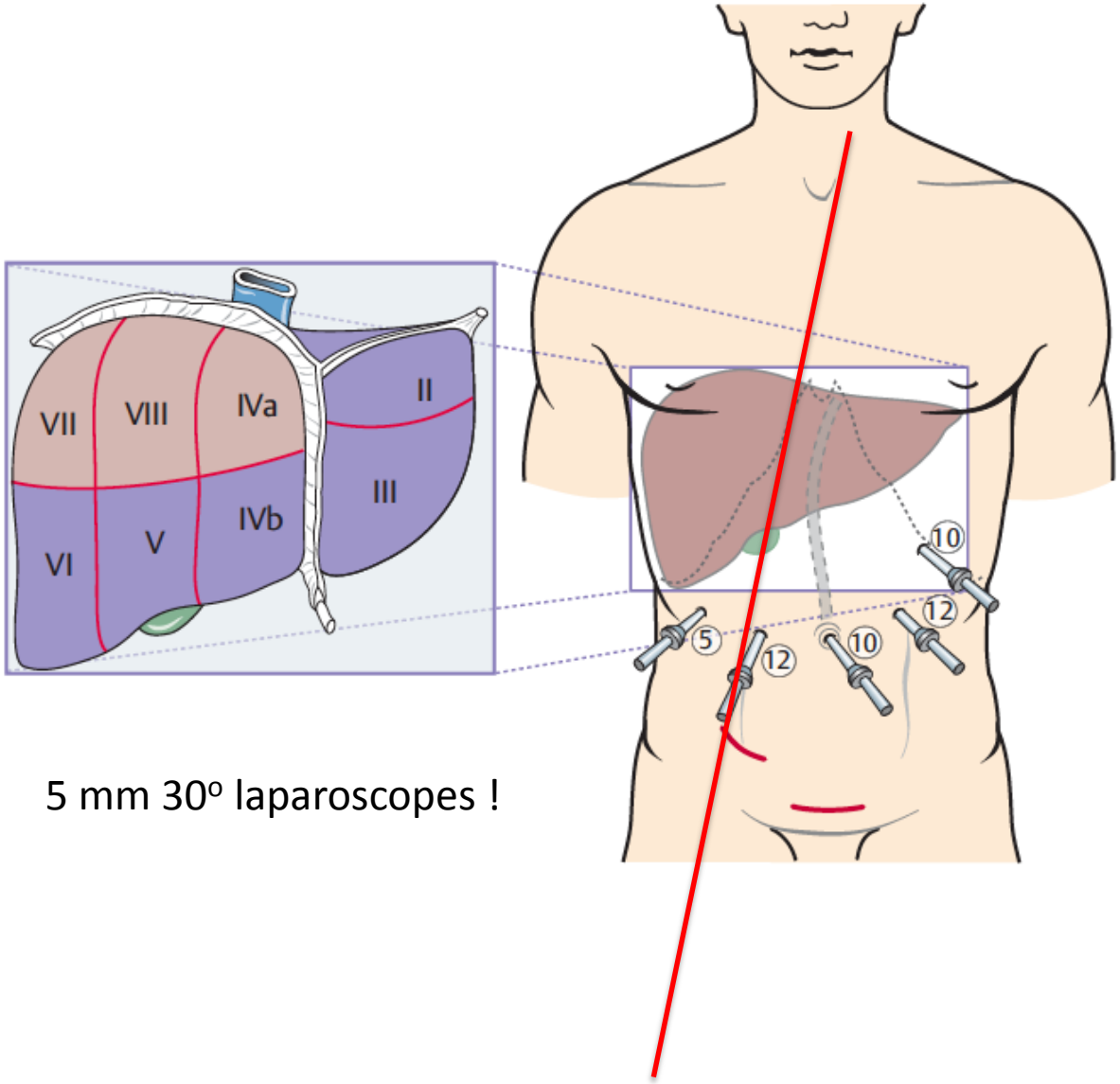
Semiprone
anterosuperior and posterior segments





Ikeda et al. *Surg Endos 2014*

Trocarts



5 mm 30° laparoscopes !

Liver handles

- Round ligament (snugger)
- Gallbladder
- Adhesions
- Sutures
- Gravity

CRC Metastasis segment 6-7

Position: left decubitis

Essential instrument I

Laparoscopic ultrasound

Essential instrument II

Laparoscopic CUSA

Essential instrument III

Gayet bipolar forceps

NO EVIDENCE NEEDED

Ethicon Enseal

Covidien Maryland

Erbe Bicision

Ethicon Ace+7

Olympus Thunderbeat

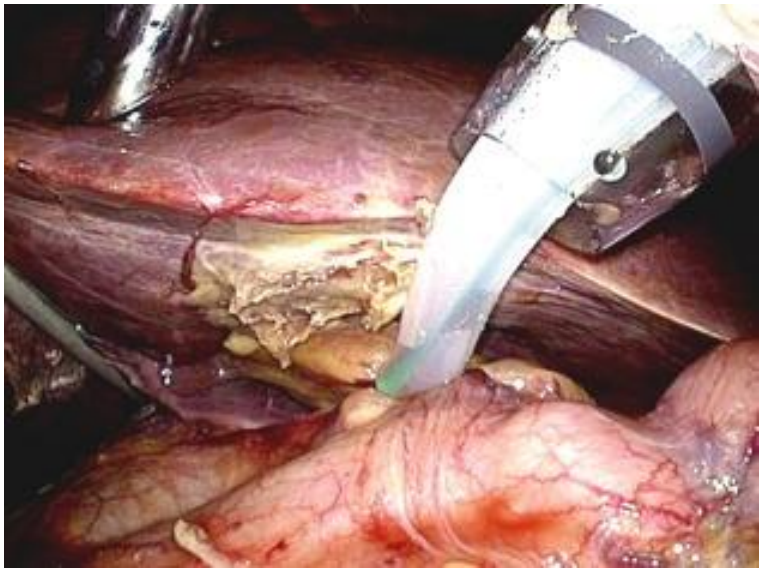
Braun Aesculap Caiman

Wireless

Covidien Sonicision

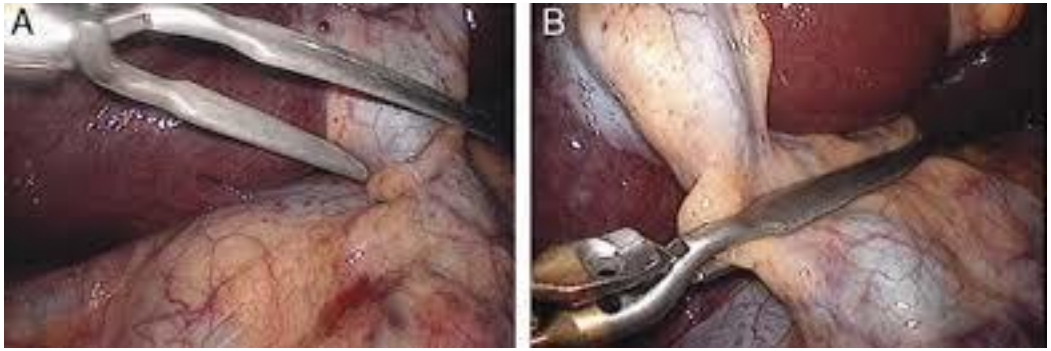
Essential IV

Pedicle control



Percutaneous snugger tape

Laparoscopic clamp



Laparoscopic bulldog

Urgent bleeding control in laparoscopic liver surgery

Keep watching the bleed! Clamp if possible.

Sponge compression and rinse

Minimal suction!

Intraperitoneal pressure ↑

PEEP Airway pressure ↓

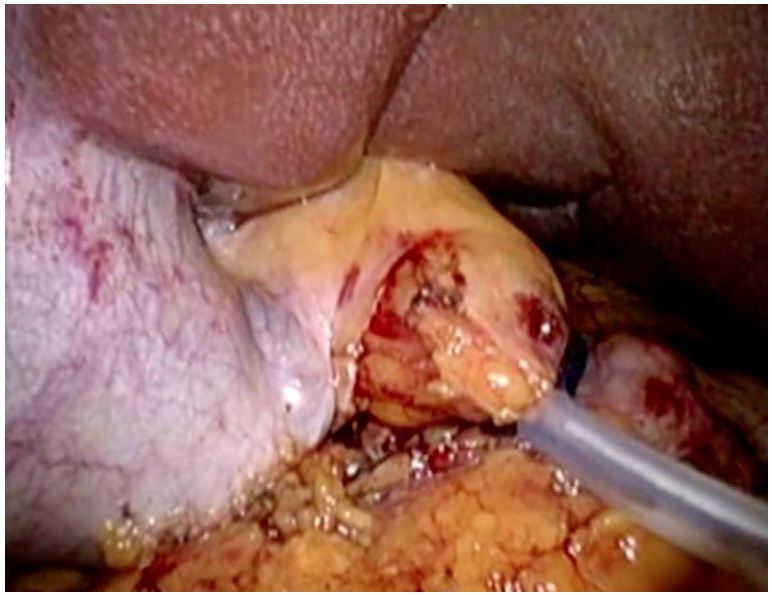
Bipolar (pre) coagulation

Suture (Goretex)

Central venous pressure ↓

Portal triad clamping (+/- selective)

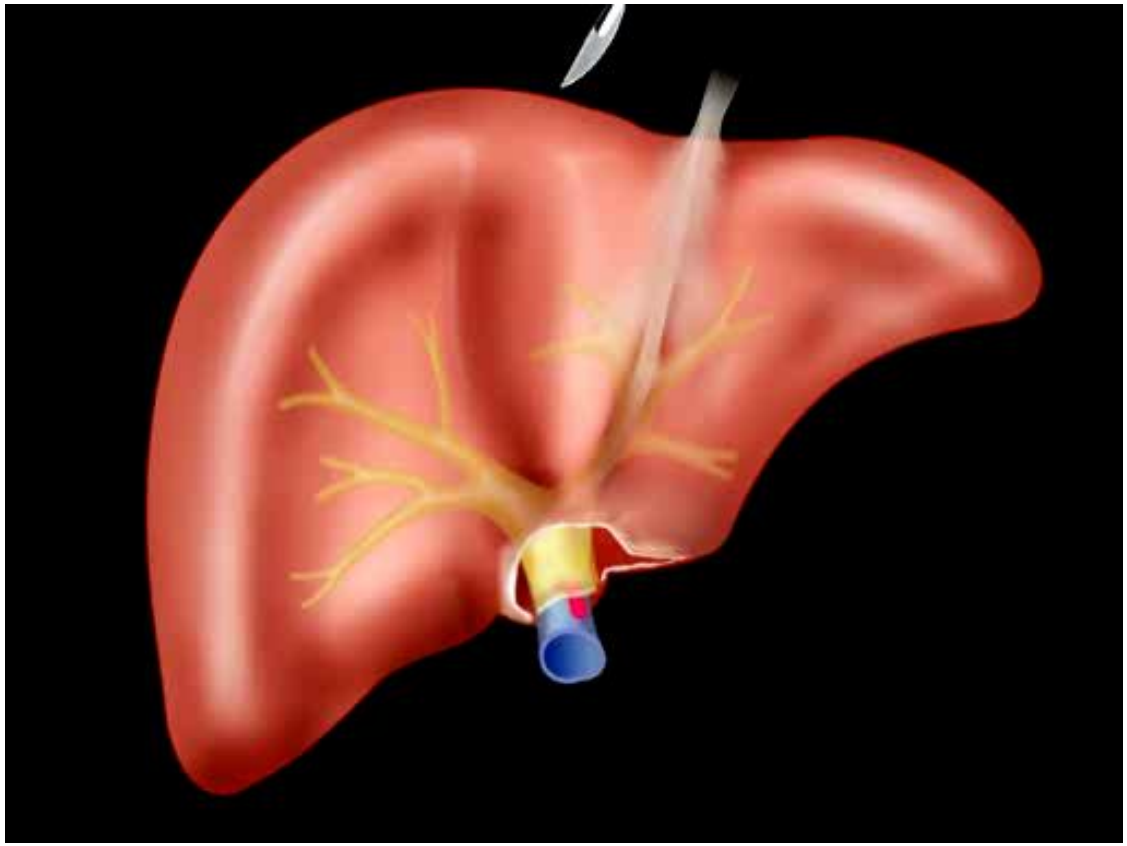
Subhepatic inferior caval vein clamping



Essentials

- Laparoscopic Ultrasound
- Laparoscopic CUSA
- Bipolar forceps
- Pedicle control
- Suturing
- 2 surgeons

Glissonian approach

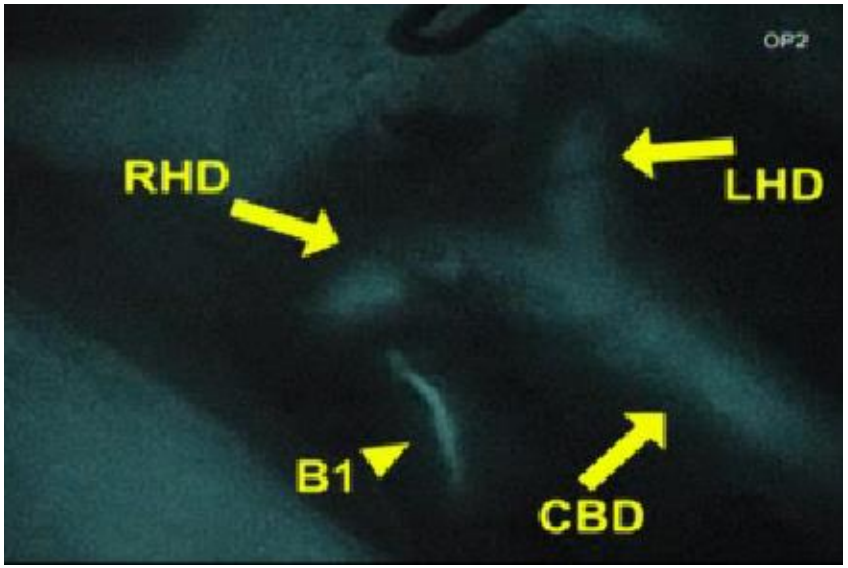


Topal et al. *Surg Endos 2007*
Machado et al. Surgery 2016

Hilar Bile Duct Identification

Intraoperative cholangiography

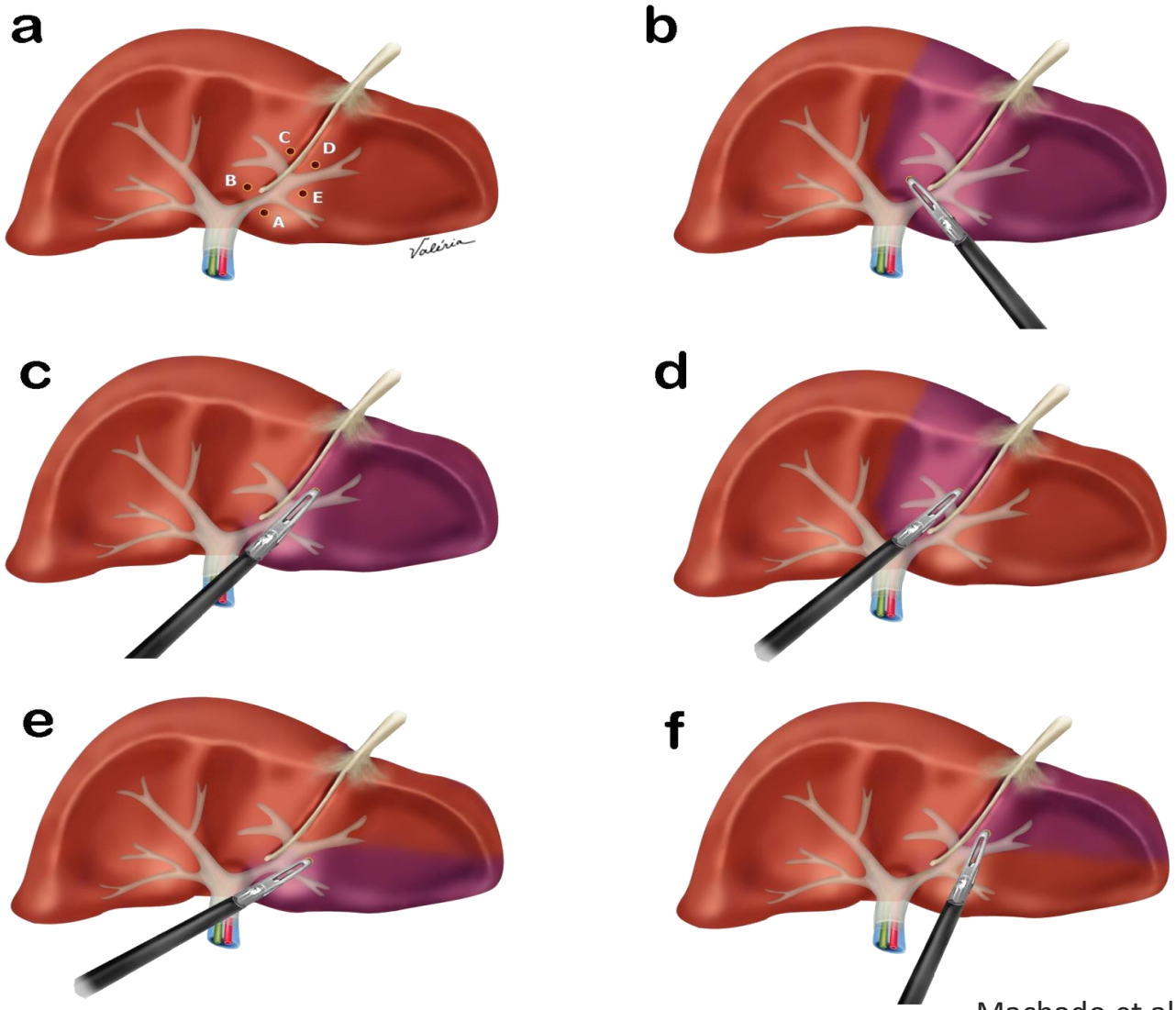
Intraoperative near infrared ICG



Topal Machado extra Glissonian technique

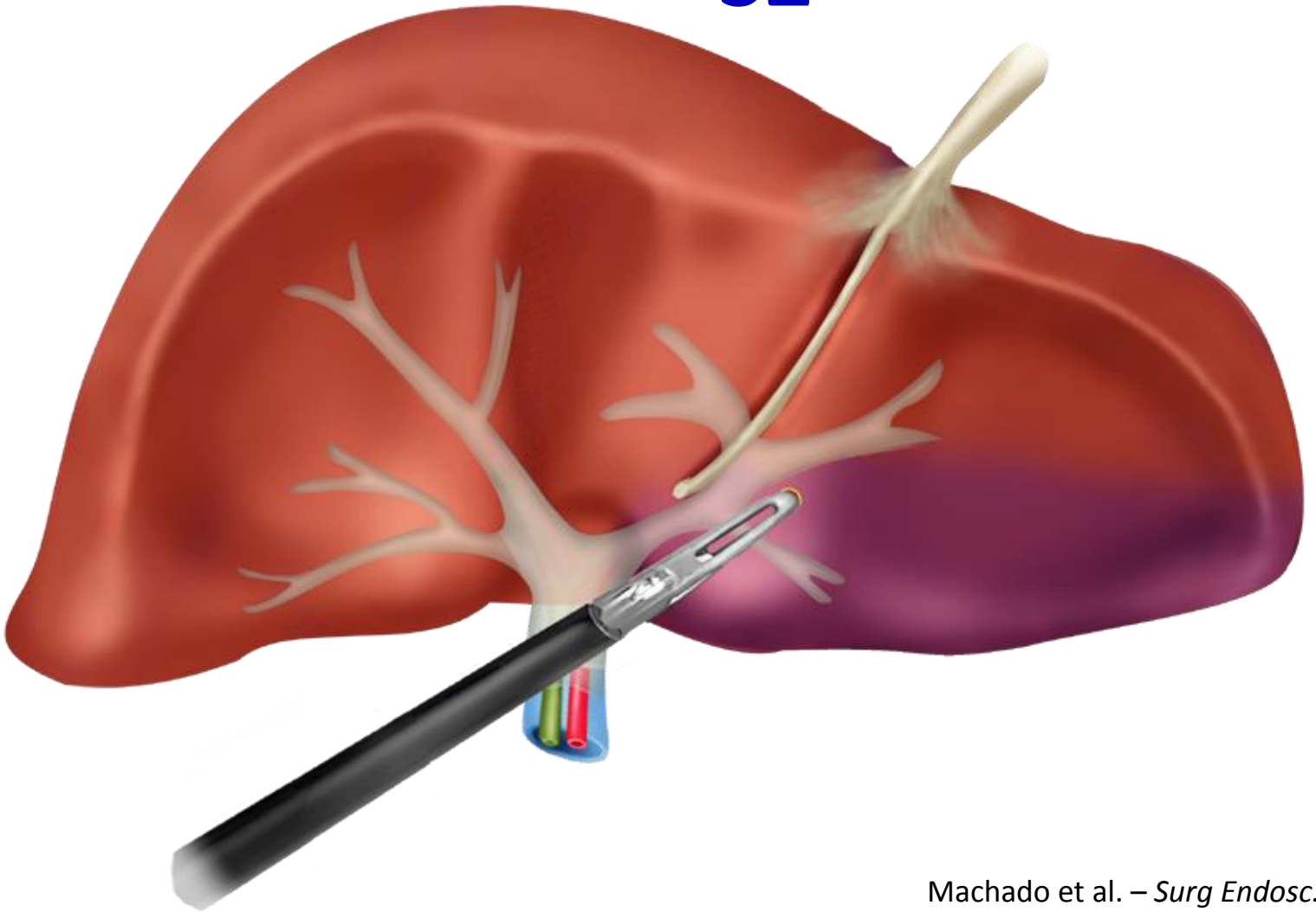
Topal et al. *Surg Endos 2007*
Machado et al. Surgery 2016

Left liver



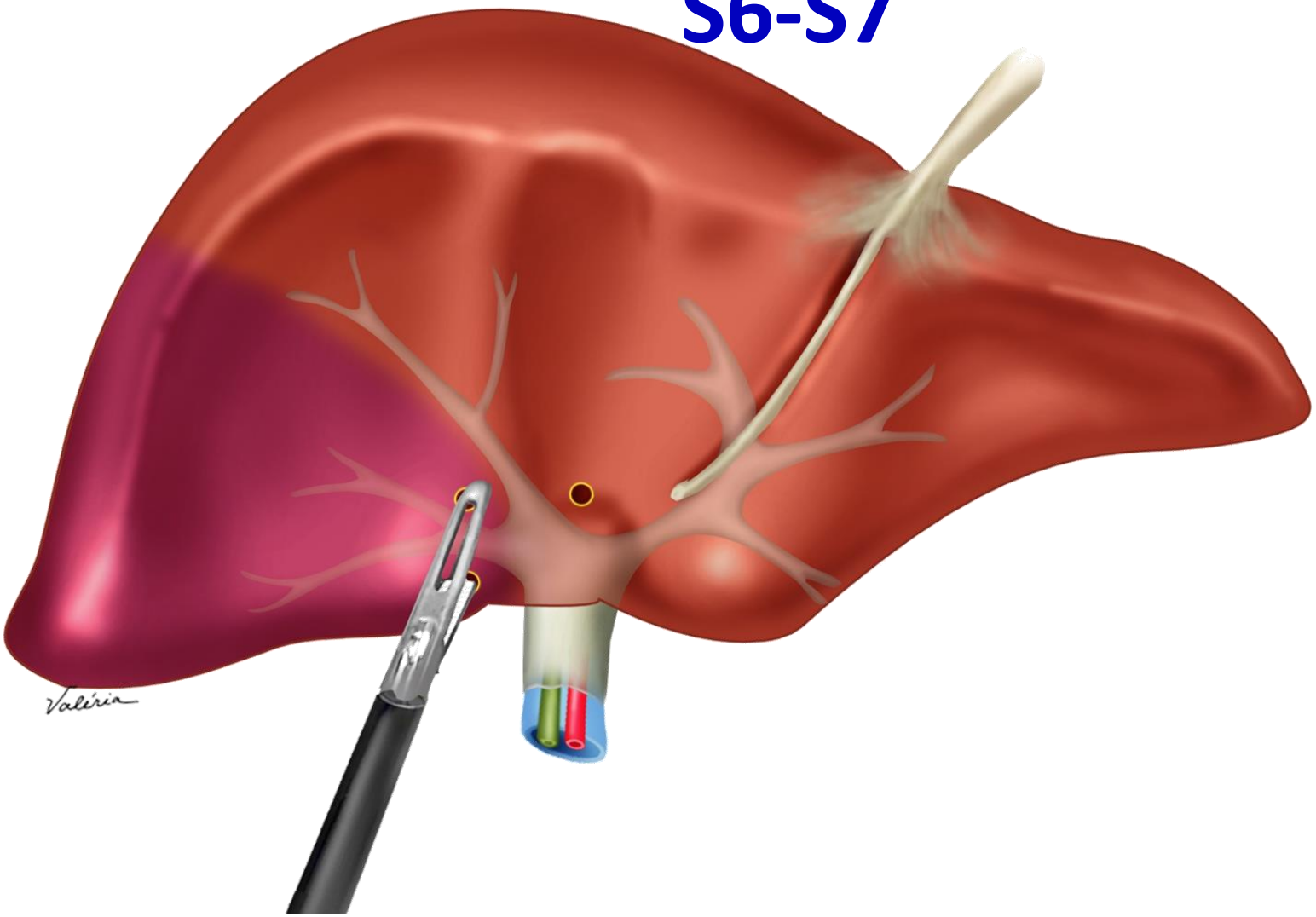
Machado et al. Surg Endos 2009

S2

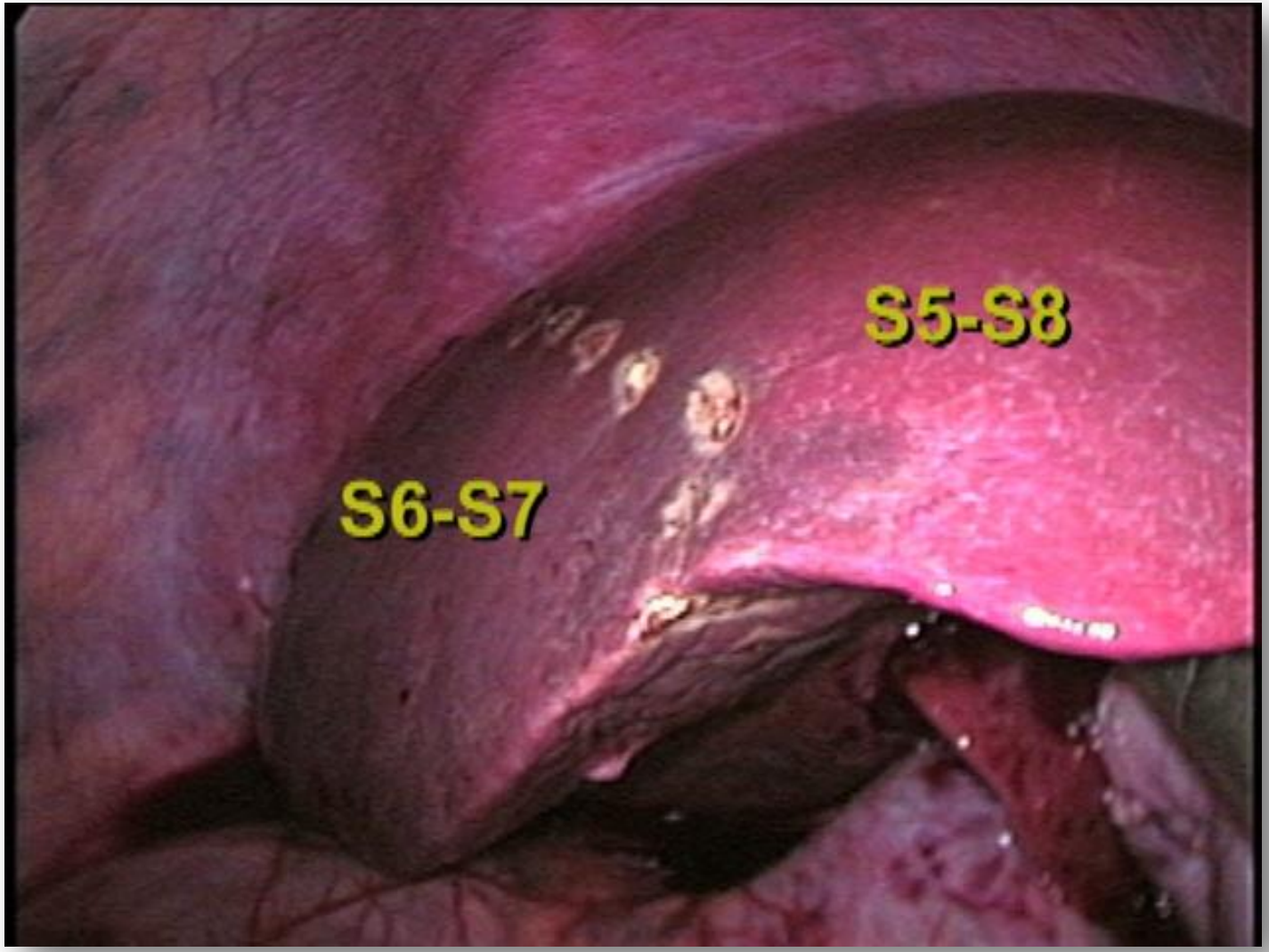


Machado et al. – *Surg Endosc. 2009*

S6-S7



Machado et al. Am J Surg 2008


S5-S8
S6-S7

Intra Hepatic Glissonian Approach

- Important alternative to hilar dissection
- Especially for hemihepatectomies
- Usefull for sectionectomy and less
- Experience!

Conclusion

- Laparoscopic liver resection
  - assessment (minor) phase
  - learning phase (major)!
  - from metastasectomy to donor, extended and ALPPS
- 3 main approaches
  - Hilar dissection
  - Glissonian
  - Lateral (+/- transthoracic)
- Planning and positioning determines success
- Lap ultrasound, energy dissector and bipolar forceps prerequisite
- Use proctorship for ≥ 10 resections (major)

….use proctor surgeons

The bird is the best!
Henry Bismuth, Cape Town 2011

www.orangetrial.eu

Jacob Jordaens, 1640
Köln, Wallraf-Richartz-Museum