OLYMPUS

Medical Expert Training

PERIOPERATIVE MANAGEMENT OF PATIENTS UNDERGOING LIVER RESECTION

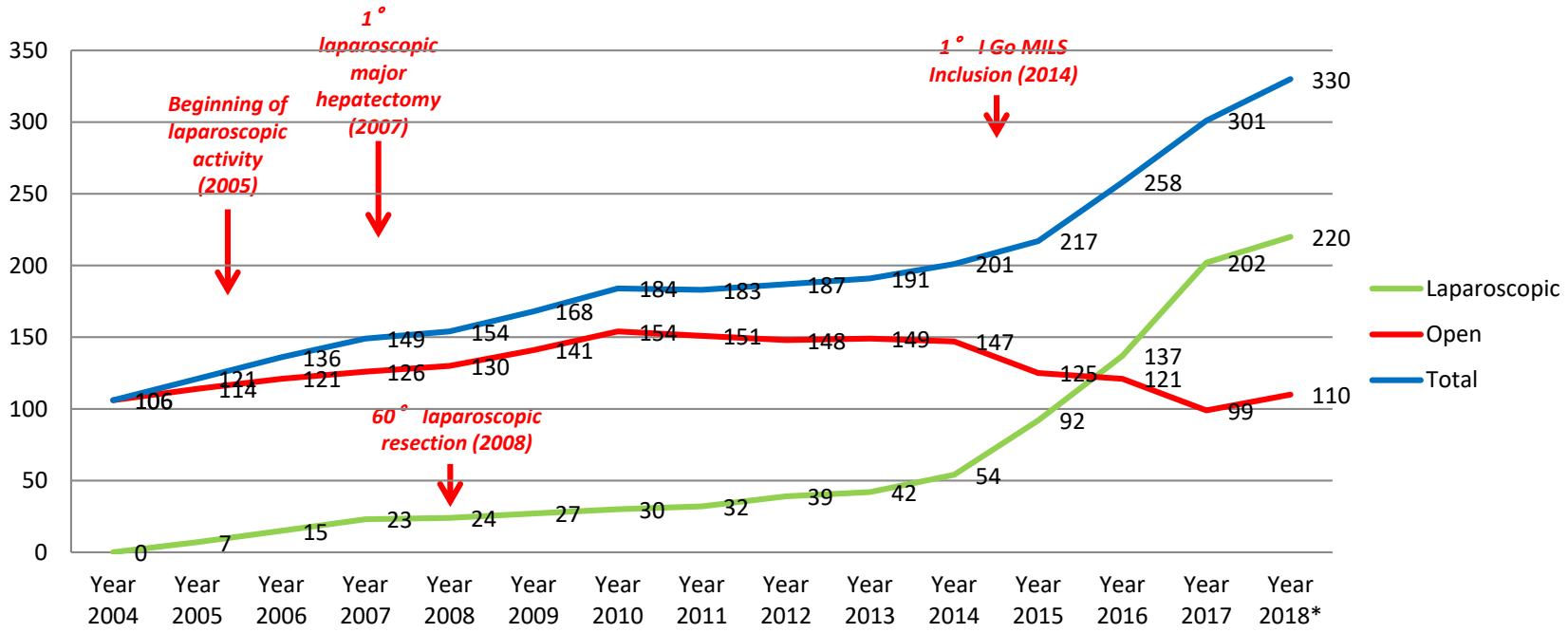
Francesca Ratti

Unità di Chirurgia Generale Epatobiliare
Ospedale San Raffaele
Milano

OLYMPUS

Medical Expert Training

Liver resection activity – Hepatobiliary Surgery Division San Raffaele Hospital, Milano (2004-2018)



2005: Ratio MILS/Whole series **5.8%**

2010: MILS/Whole series **16.3%**

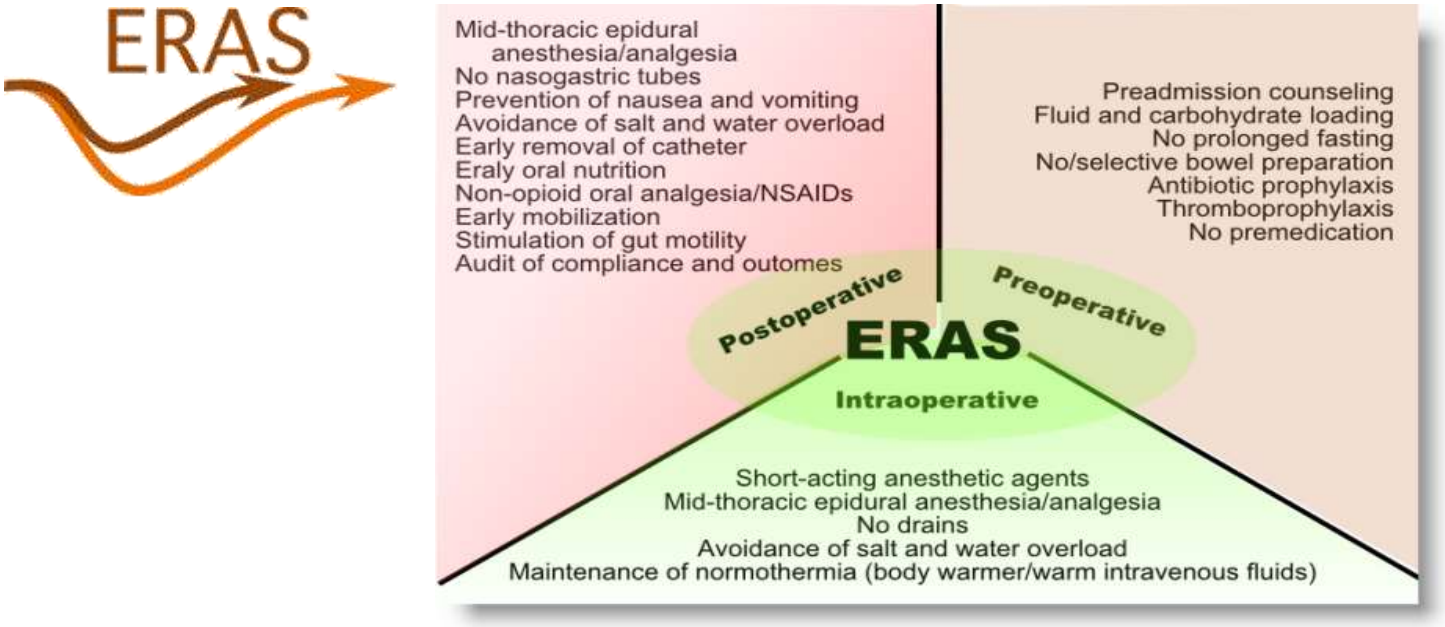
2016: MILS/Whole series **53.1%**

2018: MILS/Whole series **71.1%**

Development of «minimally invasive techniques»

Effort to implement
«minimally invasive perioperative management»

Perioperative management has been optimized to improve surgical outcome



"The establishment and adoption of evidence-based practice guidelines improves surgical outcomes"

History and background of quality measurement,
Clin Col Rectal Surg 2014

First do it better, than do it quicker

Henrik Kehlet

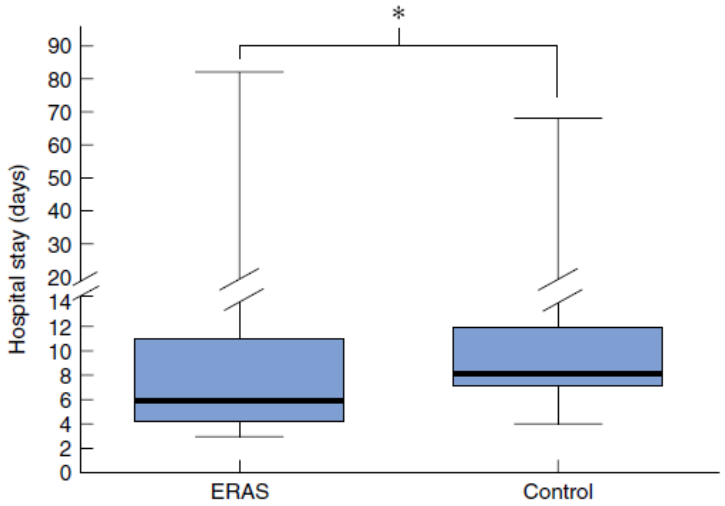
Effect of ERAS in liver surgery

Original article

Br J Surg, 2008

Initial experience with a multimodal enhanced recovery programme in patients undergoing liver resection

R. M. van Dam[1], P. O. Hendry[3], M. M. E. Coolsen[1], M. H. A. Bemelmans[1], K. Lassen[4,5], A. Revhaug[4,5], K. C. H. Fearon[3], O. J. Garden[3] and C. H. C. Dejong[1,2], on behalf of the Enhanced Recovery After Surgery (ERAS) Group



In patients treated according to ERAS protocol

- ✓ Faster functional recovery
- ✓ Shorter length of stay

ORIGINAL ARTICLE

HPB, 2009

The effect of a multimodal fast-track programme on outcomes in laparoscopic liver surgery: a multicentre pilot study

Jan H. Stoot[1], Ronald M. van Dam[1], Olivier R. Busch[2], Richard van Hillegersberg[3], Marieke De Boer[4], Steven W.M. Olde Damink[1,5], Marc H. Bemelmans[1] & Cornelis H.C. Dejong[1,5] on behalf of the Enhanced Recovery After Surgery (ERAS) Group

"A multimodal enhanced recovery programme in laparoscopic liver surgery is feasible, safe and may lead to accelerated functional recovery and reductions in LOS»

	Group 1 ERAS programme ($n = 13$)	Group 2 Traditional care ($n = 13$)	*P*-value
Primary outcome			
Total LOS, days*	5.0 (3–10)	7.0 (3–12)	0.305†
Secondary outcomes			
Functional recovery, days*	3 (1–7)	5 (2–8)	0.044†
Complications, *n* (grade)	2 (I)	2 (I)	1.0
Conversions, *n*	2	2	1.0
Blood loss, ml*	50 (50–200)	250 (50–800)	0.002†
Operation time, min*	118 (85–192)	180 (51–340)	0.293†

Review

Effect of ERAS in laparoscopic liver surgery

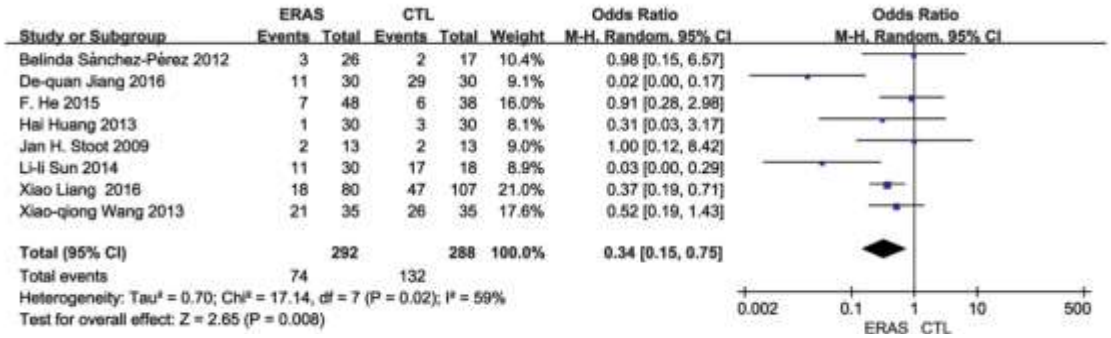
Enhanced recovery after surgery programs versus traditional perioperative care in laparoscopic hepatectomy: A meta-analysis

Rui Yang [a, 1], Wan Tao [b, 1], Yang-yang Chen [c], Bing-hong Zhang [b], Jun-ming Tang [a], Sen Zhong [a, *], Xian-xiang Chen [a, **]

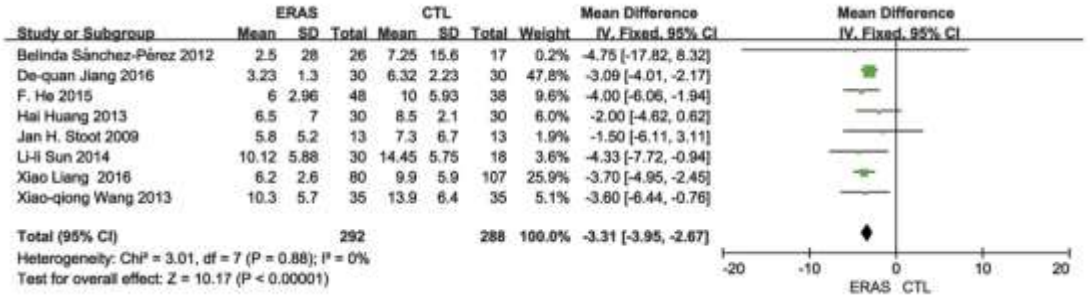
Int J Surg, 2016

550 patients from 8 RCTs or CCTs

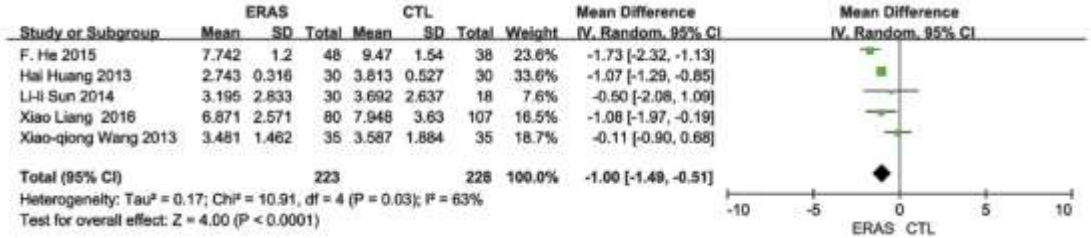
Complications



Hospital stay



Costs



Support ERAS

World J Surg (2014) 38:1127–1140
DOI 10.1007/s00268-013-2398-6

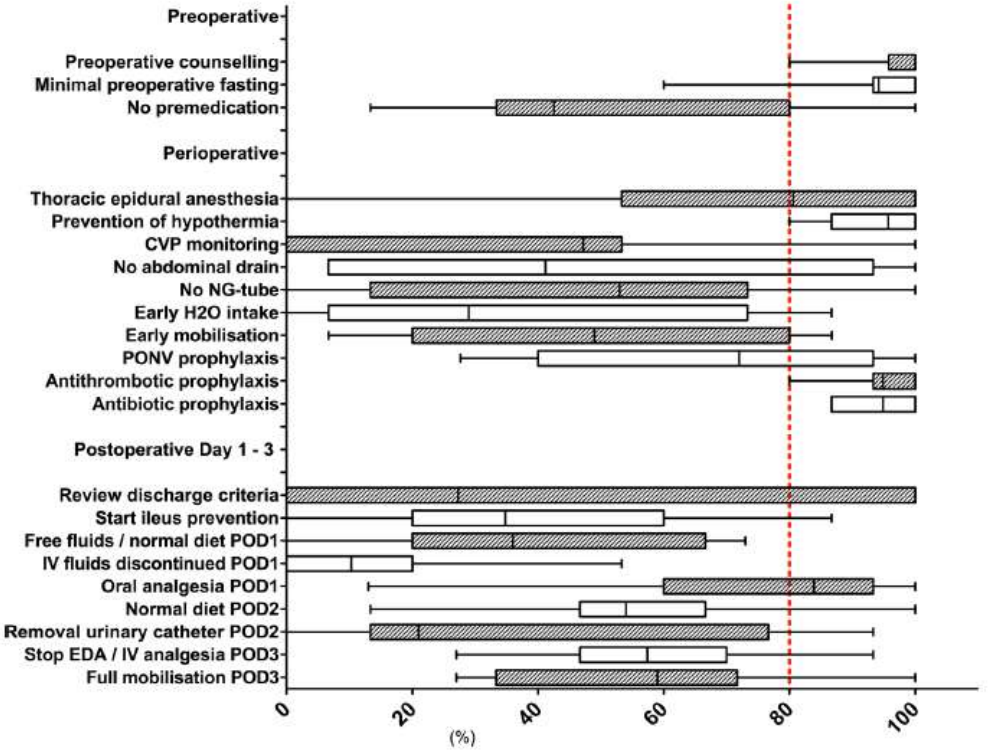
World Journal of Surgery

ERAS

Is Current Perioperative Practice in Hepatic Surgery Based on Enhanced Recovery After Surgery (ERAS) Principles?

E. M. Wong-Lun-Hing · R. M. van Dam · L. A. Heijnen · O. R. C. Busch · T. Terkivatan · R. van Hillegersberg · G. D. Slooter · J. Klaase · J. H. W. de Wilt · K. Bosscha · U. P. Neumann · B. Topal · L. A. Aldrighetti · C. H. C. Dejong

"Perioperative care among centers that perform liver resections varied substantially and elements of enhanced recovery programs had already been implemented as part of daily surgical practice. This may standardize care and improve recovery after liver surgery".



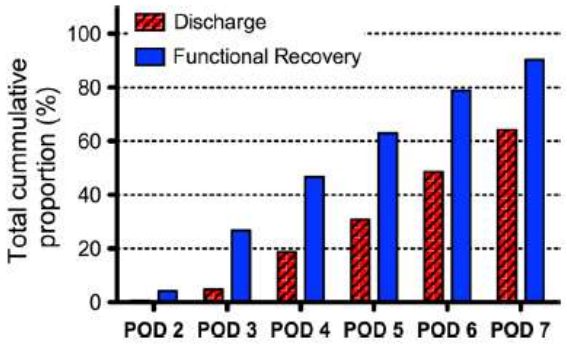
World J Surg (2014) 38:1127–1140
DOI 10.1007/s00268-013-2398-6

World Journal of Surgery

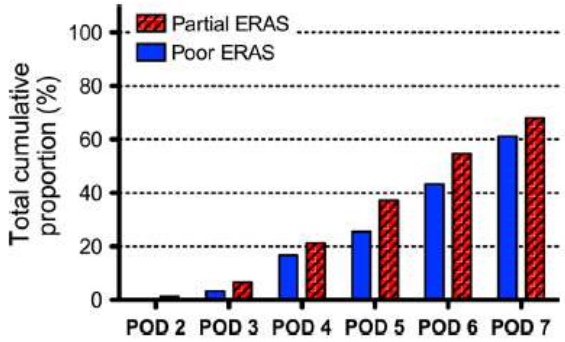
ERAS

Is Current Perioperative Practice in Hepatic Surgery Based on Enhanced Recovery After Surgery (ERAS) Principles?

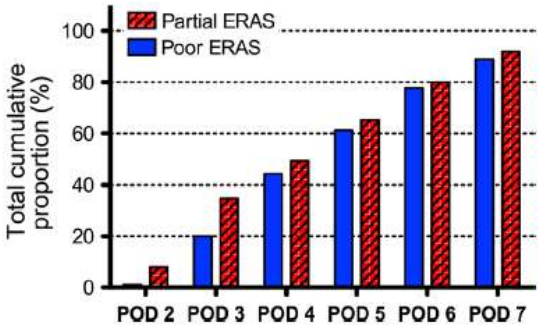
E. M. Wong-Lun-Hing · R. M. van Dam · L. A. Heijnen · O. R. C. Busch · T. Terkivatan · R. van Hillegersberg · G. D. Slooter · J. Klaase · J. H. W. de Wilt · K. Bosscha · U. P. Neumann · B. Topal · L. A. Aldrighetti · C. H. C. Dejong



Discrepancy between functional recovery and discharge



Faster discharge in centers with more extensive adoption of ERAS protocol



Faster functional recovery in centers with more extensive adoption of ERAS protocol

World J Surg (2016) 40:2425–2440
DOI 10.1007/s00268-016-3700-1

World Journal of Surgery

SCIENTIFIC REVIEW

Guidelines for Perioperative Care for Liver Surgery: Enhanced Recovery After Surgery (ERAS) Society Recommendations

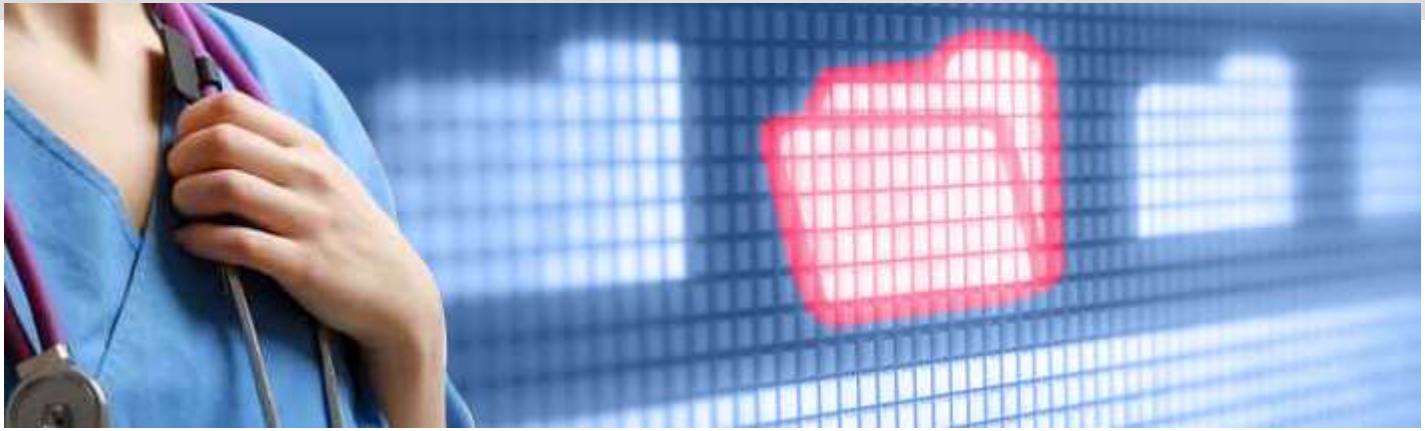
Emmanuel Melloul[1,2] · Martin Hübner[1] · Michael Scott[3] · Chris Snowden[4,5] · James Prentis[6] · Cornelis H. C. Dejong[7] · O. James Garden[8] · Olivier Farges[9] · Norihiro Kokudo[10] · Jean-Nicolas Vauthey[11] · Pierre-Alain Clavien[12] · Nicolas Demartines[1]

Table 2 RCTs dedicated to liver surgery selected in the systematic review with the level of evidence

Author	Year	Jadad score	Level evidence	Studied items	Morbidity	LOS
Lassen	2008	6	1	Postoperative artificial nutrition	No difference	No difference
Darouiche	2010	4	1	Skin preparation	Preoperative cleansing with chlorhexidine is superior to povidone-iodine for preventing SSI	Not assessed
Hayashi	2011	7	1	Perioperative steroids administration	Positive impact on liver function. No difference in complications	No difference
Wong	2007	5	2	Preventing intraoperative hypothermia	Perioperative warming reduce blood loss and complications	No difference
Okabayashi	2009	3	2	Postoperative glycaemic control	Intensive insulin therapy using a closed-loop system lower SSI	Decreased
Pessaux	2007	5	2	Prophylactic Nasogastric intubation (NGT)	NGT has no advantage. NGT increased the risk of pulmonary complications	No difference
Igami	2011	4	2	Prevention of delayed gastric emptying (DGE)	DGE reduced with omental flap on the cut surface after left-sided hepatectomy	Not assessed
Yoshida	2005	3	2	Prevention of delayed gastric emptying (DGE)	DGE reduced with omental flap on the cut surface after left-sided hepatectomy	Not assessed
Hendry	2010	2	2	Use of postoperative laxatives	Earlier passage of first stool, no change in morbidity	Decreased
Jones	2013	7	1	Goal-directed fluid therapy	Decreased	Decreased

LOS length of hospital stay

Italian Perioperative Program



Italian Perioperative Program

Protocollo resezioni epatiche

Versione: Novembre 2014

Team Coordinator:

Dr. Luca Aldeghieri
e-mail: aldeghieri.luca@hsr.it
Primario chirurgia Epatobiliare Ospedale San Raffaele Milano

Referenti:

Chirurgo

Dr. Luca Aldeghieri
e-mail: aldeghieri.luca@hsr.it

Dr.ssa Ratti Francesca
e-mail: ratti.francesca@hsr.it

Dr.ssa Cipriani Federica
e-mail: cipriani.federica@hsr.it

Dr.ssa Gallinaro Annalisa
e-mail: gallinaro.annalisa@hsr.it

Anestesista

Dr.ssa Raffaella Reineke (Referente ERAS)
e-mail: reineke.raffaella@hsr.it

Dr.ssa Consorti Laura (CAA)
e-mail: consorti.laura@hsr.it

Dr.ssa Morero Silvia
e-mail: morero.silvia@hsr.it

Dr.ssa Elena Frati
e-mail: elefrati@hotmail.it

Infermiere

Dr. Umberto Cauzaglia
e-mail: cauzaglia.umberto@hsr.it

Dr.ssa Bassani Elisabetta
e-mail: bassani.elisabetta@hsr.it

OSPEDALE SAN RAFFAELE
ISTITUTO DI RICOVERO E CURA A CARATTERE SCIENTIFICO

Unità Operativa Complessa
CHIRURGIA EPATOBILIARE e WEFR SURGERY
Direttore: Prof. Gianfranco Forlo
Unità Funzionale CHIRURGIA EPATOBILIARE
Responsabile: Dott. Luca Aldeghieri

LA RESEZIONE EPATICA:
INFORMAZIONI PER IL PAZIENTE

La resezione epatica è un intervento chirurgico che consiste nell'asportazione di una porzione di fegato affetta da patologia. L'intervento è di tipo di resezione epatica viene definito sulla base dell'estensione del tumore che deriva dalla modalità della sua diffusione oncologica.

CENNI DI ANATOMIA DEL FEGATO

Il fegato è un organo impari situato nella parte superiore destra dell'addome, dove è sostenuto alla parete addominale da alcuni legamenti ed occupa per la maggior parte lo spazio al di sotto dell'arcata costale destra.
Sulla superficie anteriore del fegato è ben visibile la legamento falciforme che si inserisce longitudinalmente dividendo il fegato in un lobo anatomico sinistro (a piccolo lobo) ed un lobo anatomico destro. Sulla faccia inferiore è anche visibile la cistifellea che è situata in un "letto" del lobo epatico destro.
Attraverso il peduncolo epatico arrivano all'ingresso del fegato (da epatico) tre strutture principali: l'arteria epatica, che fornisce sangue ossigenato proveniente dall'aorta; la vena porta che trasporta sangue che proviene dall'intestino, dalla milza e dal pancreas; le vie biliari (composte dal colledoco e dai dotti epatici) che raccoglie la bile prodotta dal fegato per portarla nell'intestino dove svolgerà la sua funzione digestiva.

OSPEDALE SAN RAFFAELE
ISTITUTO DI RICOVERO E CURA A CARATTERE SCIENTIFICO

ANESTESIA E ANALGESIA POST-OPERATORIA NELLA CHIRURGIA EPATO-BILIARE

U.O. di Anestesia Generale
Direttore Prof. Luigi Beretta

Gentilissimo Paziente,

questa piccola brochure informativa ha lo scopo di volerLe spiegare, nel miglior modo possibile, le tecniche di anestesia ed analgesia (assenza del dolore) a cui verrete sottoposti.

Questo ospedale, ma soprattutto il TEAM EPATO-BILIARE a cui Lei si è rivolto, ha sposato l'idea di un lavoro d'equipe (Chirurgo, Anestesista ed Infermieri hanno sviluppato una competenza specifica negli interventi su fegato e vie biliari e condividono i protocolli), volto a migliorare ed a ottimizzare l'assistenza clinica durante il Suo soggiorno in ospedale, nell'ambito di un programma noto con l'acronimo ERAS (Enhanced Recovery After Surgery, cioè "rapido recupero dopo la chirurgia").

A questo scopo, ci verrà di rendere più agevole la Sua postoperatoria a seguito di una preparazione ottimale e di una attenta gestione intraoperatoria.

Il medico Anestesista sarà al suo fianco durante questo percorso cercando di rendere il periodo postoperatorio meno doloroso possibile. In assenza di dolore il recupero delle normali funzioni vitali sarà più rapido ed agevole. Pertanto il nostro scopo è quello di organizzare un trattamento anestesiologico confezionato "su misura" per Lei, in accordo con la tipologia di intervento decisa dal Chirurgo.

L'intervento chirurgico necessita di un'anestesia GENERALE, che provoca la perdita di coscienza, la rilassamento (il rilassamento di tutti i suoi muscoli per rendere possibile l'intervento) e di una adeguata assenza del dolore. Al fine di garantire un'ottimale copertura del dolore, soprattutto nei primi giorni dopo l'intervento chirurgico, l' anestesia in sala operatoria associerà, all'anestesia generale, una tecnica di analgesia postoperatoria, utilizzando un blocco nervoso centrale o periferico laddove sarà possibile.

Le tecniche di analgesia postoperatoria, associate all'anestesia generale, nella chirurgia epato-biliare sono le seguenti:

1. Analgesia EPIDURALE: in sala operatoria, prima di iniziare l'anestesia generale, con paziente seduto, viene inserito un piccolo catetere peridurale nella schiena a livello toracico, previa anestesia locale. La manovra non è dolorosa, ma fotografa semplicemente pazientare affinché l'anestesista possa posizionarlo correttamente. Attraverso questo catetere verrà somministrato un farmaco anestetico locale, in questo modo la trasmissione del dolore da parte delle fibre nervose contenute nello spazio peridurale che inervano la zona dell' intervento chirurgico verrà bloccata dall'anestetico locale.

Inclusion criteria

- ✓ All the patients undergoing liver resection, irrespectively of both the extension of the resection (major or minor) and the approach (laparoscopic or open) are treated according to ERAS protocol
- ✓ All the patients requiring liver surgery in association with procedures including common bile duct resection (e.g. biliary-enteric anastomosis) or colorectal resections (e.g. patients undergoing combined resection of colorectal cancer with synchronous liver metastases) are treated according to ERAS protocol

a. Preoperative step (outpatient)

1. Surgical evaluation

   - Indication to surgery
   - Trasfusion Risk Score evaluation and, if necessary, activation of «anaemia protocol»
   - Evaluation of nutritional status by the means of MUST index (Malnutritional Universal Screening Tool).
   - Navigator Nurse (NaNu) takes charge of the patient

* If nutritional status is not adequate (weight loss of 10-15% in the last 6 months, BMI<18.5, serum albumin <30) the intake of oral supplements (immunonutrition) is recommended 5-7 days before surgery. In case of severe malnutrition, enteral nutrition supplement is considered

a. Preoperative step (outpatient)

2. Meeting with Navigator Nurse (within the week following surgical evaluation)

- Nurse Counselling for the patient
- Nurse Counselling for the caregiver
- Evaluation of motility and self-care autonomy by administration of a specific questionnaire
  - If necessary, a preoperative/postoperative physiotherapy support is required
- Evaluation of the psychological status (together with Clinical Psychologists)

3. Preoperative meeting with the hepatobiliary team (surgeon, anaesthersiologist), which will take place in the hospital 2-4 weeks before surgery.

a. Preoperative step (inpatient)

✓No bowel preparation (unless the patient referres no canalization in the 3 days before surgery)

✓Routine blood tests, typing of blood group. Blood units are required to be available during surgery (According to Transfusion Risk Score – TRS)

✓Depilation

✓Dinner and intake of 2 packages (400 ml) of PREOP (12,5 gr of maltodestrin/100 ml of drink). No intake of solid food for 6 hours and no intake of liquids for 2 hours before surgery

✓No anaesthetic premedication

✓Antibiotic therapy is started if a biliary drainage is in place

b. Intraoperative step

- Liver resections are performed under general anaesthesia, with the association, if possible, of a locoregional analgesia technique, to obtain an adequate control of postoperative pain.

- Management protocols (especially in terms of analgesia) can be classified according to the planned resection :

Tailored standardization

MAJOR OPEN LIVER RESECTIONS (≥ 3 hepatic segments)	MINOR OPEN LIVER RESECTIONS (≤ 3 hepatic segments)	LAPAROSCOPIC LIVER RESECTIONS

b. Intraoperative step

	Minor Open	Major Open	Laparoscopic	Perihilar
CVC	No	No	No	No
Vigileo	Yes	Yes	Yes	Yes)
Anaesthesia	Gen + Peri or Gen + Spin (ev. TAP)	Gen + PVB	Gen + Spin (ev. TAP) or Gen + ESP	Gen + PVB
Paracetamol	1g x 3	1g x 3	1g x 3	1g x 3
Tapentadol	NO	As rescue	50 mg x 2	No
NSAID	Ketorolac 30 mg ab (max 90 mg die) as rescue	Ketorolac 30 mg ab (max 90 mg die) as rescue	Ketorolac 30 mg ab (max 90 mg die) as rescue	Ketorolac 30 mg ab (max 90 mg die) as rescue

A nutritional digiunostomy is considered whenever a patient requiring a major or extended resection has a significant risk of postoperative liver failure

ORIGINAL ARTICLE

HPB, 2016

Intraoperative monitoring of stroke volume variation versus central venous pressure in laparoscopic liver surgery: a randomized prospective comparative trial

Francesca Ratti[1], Federica Cipriani[1], Raffaella Reineke[2], Marco Catena[1], Michele Paganelli[1], Laura Comotti[2], Luigi Beretta[2] & Luca Aldrighetti[1]

[1]Division of Hepatobiliary Surgery, and [2]Department of Anaesthesiology and Intensive Care, IRCCS San Raffaele Hospital, Milano, Italy

		SVV group (n = 45)	CVP group (n = 45)	p
Conversion, n (%)		3 (6.7)	8 (17.8)	0.02
Reason for conversion, n (%)				
	Haemorrhage	0 (0)	4 (8.9)	0.05
	Oncologic inadequacy	1 (2.2)	2 (4.4)	ns
	Anaesthesiological problems	0 (0)	1 (2.2)	ns
	Damage to the liver	1 (2.2)	0 (0)	ns
	Inadequate biliostasis	1 (2.2)	0 (0)	ns

		SVV group (n = 45)	CVP group (n = 45)	p
Pringle manoeuvre, n (%)				ns
	Not performed	19 (42.2)	24 (53.3)	
	Performed	26 (57.8)	21 (46.7)	
Length of surgery (min)	Mean ± SD	220 ± 50	210 ± 60	ns
Blood Loss (mL)	Mean ± SD	150 ± 100	300 ± 250	0.04
Associated procedures, n (%)				ns
	None	39 (86.7)	41 (91.1)	
	Colecistectomy	6 (13.3)	4 (8.9)	
Surgical margin, n (%)				ns
	R0	44 (97.8)	45 (100)	
	R1	1 (2.2)	0 (0)	
Surgical margin (mm)	Mean ± SD	8 ± 4	9 ± 6	ns
Intraoperative blood transfusions, n (%)				ns
	No	43 (95.6)	43 (95.6)	
	Yes	2 (4.4)	2 (4.4)	
Total blood transfusions, n (%)				ns
	No	43 (95.6)	41 (91.1)	
	Yes	2 (4.4)	4 (8.9)	
Morbidity, n (%)		5 (11.1)	6 (13.3)	ns
Grade of complications, n (%)				
Minor	I grade	1 (2.2)	1 (2.2)	ns
	II grade	2 (4.4)	3 (6.7)	ns
Major	IIIa grade	1 (2.2)	1 (2.2)	ns
Mortality, n (%)		0 (0)	0 (0)	ns
Functional recovery (days)	Median (range)	3 (1–6)	3 (1–7)	ns
Length of stay (days)	Median (range)	4 (2–10)	5 (3–13)	ns

b. Intraoperative step

- Antibiotic prophylaxis (1° generation cefalosporin) and single dose of methilprednisolon according to body weight
- Active warming-up of the patient
- Nasogastric/orogastric tube removed at the end of the procedure
- Monitoring of the volemic status by minimally invasive techniques (EV1000: Stroke Volume Variation, Stroke Volume, Cardiac Output, Oxygen Delivery)
- Liver transection is performed within hypovolemic status (SVV between 15 and 20%): normal volemia is restored at the end of the procedure. Cristalloids infusion 3-4 mL/kg/h
- No abdominal drainage, unless specific contraindications
  - Unsatisfactory biliostasis/haemostasis at the end of procedure
  - Redo surgery
  - Resections of areas not easily accessible by percutaneous drainage
  - Patients requiring biliary enteric anastomosis or colorectal anastomosis
  - Patients with biliary enteric anastomosis (risk of intrahepatic abscesses)
- No ICU

EUROPEAN GUIDELINES for anaesthesiological management

Evidence-based, perioperative Goal-Directed Therapy (GDT) protocols.

Several single centre randomized controlled trials, meta-analysis and quality improvement programs have shown that perioperative GDT decreases postoperative complications and hospital length of stay when compared to standard fluid management.[1-5]

This summary describes the three main perioperative GDT strategies which have been successfully used to decrease postoperative morbidity and length of stay:

- **Stroke Volume (SV) optimization with fluid**
- **Oxygen Delivery Index (iDO_2) optimization with fluid and inotropes**
- **Pulse Pressure Variation (PPV) or Stroke Volume Variation (SVV) optimization with fluid**

This summary does not recommend the use of any specific medical device, and the choice of the treatment protocol is left at the discretion of the anesthesiologist in charge.

c. Postoperative step

- ✓ Antithrombotic profilaxis: from the night of surgery, according to institutional protocols (controindications: < 6 h from surgery; PLT<50.000; INR>1,8; resection of more than 70% of the liver parenchyma)
- ✓ Ev fluids and other therapies: crystalloids 10 ml/kg/die ev. In case of hypotension, use of inotrope or vasopressor drugs is allowed. Diuretic stimulation if diuresis under 30-40 ml/h. In all the patients use of PPI is recommended, as well as ondansetron 4 mg ev to treat PONV.
- ✓ Nutrition: when awake, the patient can take liquids. Oral diet is allowed is the patient is back in the ward before 2 p.m.
- ✓ Analgesia
- ✓ No antibiotic prophylaxis (unless the patient has a biliary drainage or a biliary enteric anastomosis)

c. Postoperative step

First POD

- Ev fluids and other therapies: crystalloids 10 ml/kg/die ev. In case of hypotension, use of inotrope or vasopressor drugs is allowed. Diuretic stimulation if diuresis under 30-40 ml/h. In all the patients use of PPI is recommended, as well as ondansetron 4 mg ev to treat PONV.
- Enteral feeding: allowed if the patient tolerates it
- Early mobilization: at least 4 hours seat
- Pain control: as in POD 0

Second POD

- Ev fluids and other therapies: Ev fluids discontinuation, removal of catheter for diuresis and CVC (in patients who have it). In all the patients use of PPI is recommended. Contraindications for fluids discontinuation: no normovolemic status, no adequate oral liquids intake, increased transaminases (>1000 AST or ALT), perihilar tumors
- Enteral feeding: the patient drinks at least 1500 mL of fluids and have normal oral diet
- Early mobilization: at least 6 hours seat . Deambulation
- Pain control

c. Postoperative step

Third POD

- Enteral feeding: the patient drinks at least 1500 mL of fluids and have normal oral diet
- Early mobilization: Deambulation
- Discharge criteria evaluation

Forth POD

- Enteral feeding: the patient drinks at least 1500 mL of fluids and have normal oral diet
- Early mobilization: Deambulation
- Pain control: with oral analgesics only
- If all discharge criteria are met and the patient agrees, he/she can be discharged

Discharge criteria

- **Adequate oral feeding**
- **Adequate pain control with oral analgesics**
- **Normal deambulation and self-care autonomy**
- **No complications**
- **Patient agreement**

OSR hyper-ERAS PROTOCOL

Inclusion criteria

Surgery (only laparoscopic):

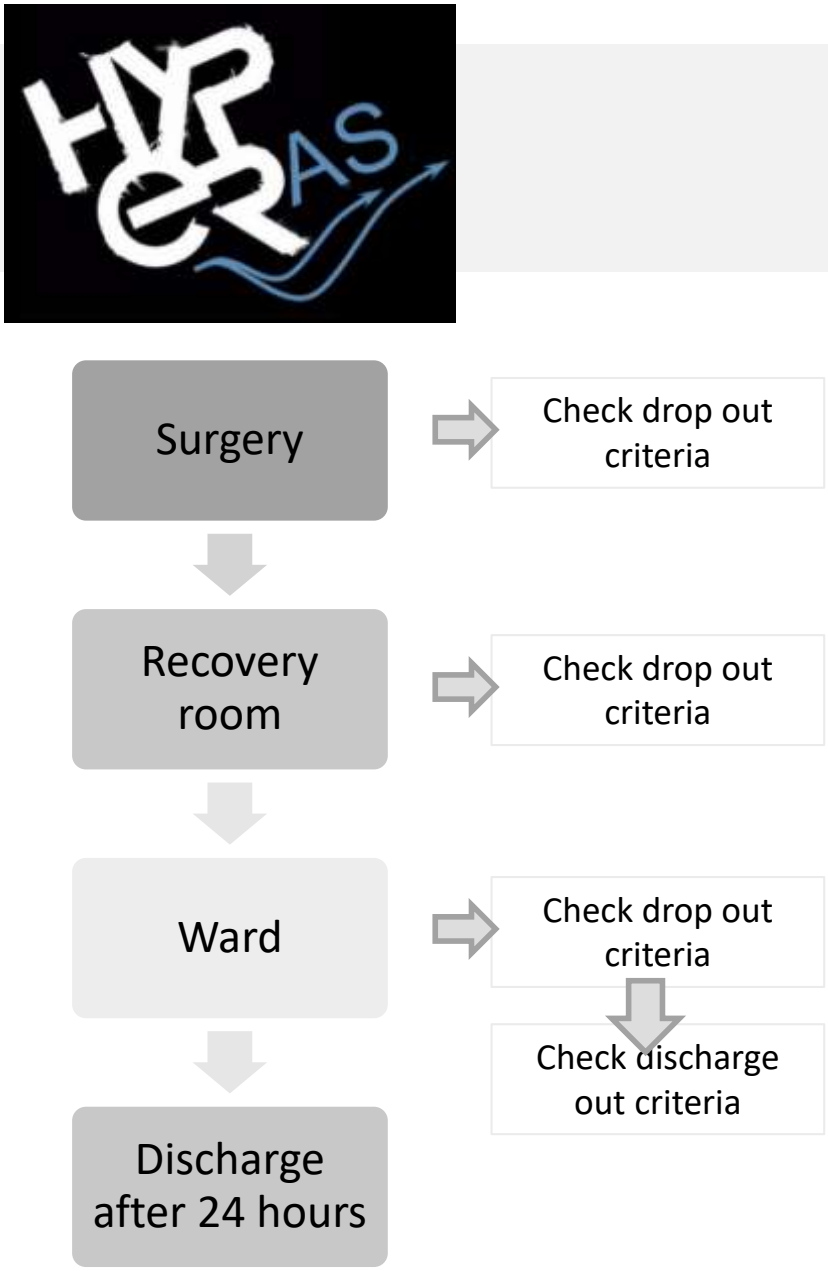
- Cysts unroofing
- Minor resections (<3 segments)
- Lesions in “laparoscopic” segments
- First resection (redo excluded)

Patient

- Age<75 years
- ASA I and II
- Adequate nutritional status
- Trasfusion Risk Score = 0 o 1

Environment

- Presence of the caregiver
- Less than 30’ far from OSR
- Adequate level of comprehension



Digestive Liver Disease, 2016

Oncology

Impact of ERAS approach and minimally-invasive techniques on outcome of patients undergoing liver surgery for hepatocellular carcinoma

Francesca Ratti[a,*], Federica Cipriani[a], Raffaella Reineke[b], Marco Catena[a], Laura Comotti[b], Luigi Beretta[b], Luca Aldrighetti[a]

From January to May 2014, 1583 hepatic resections were performed at the Hepatobiliary Surgery Division of San Raffaele Hospital, Milano

364 (23%) performed for HCC

249 minor resections

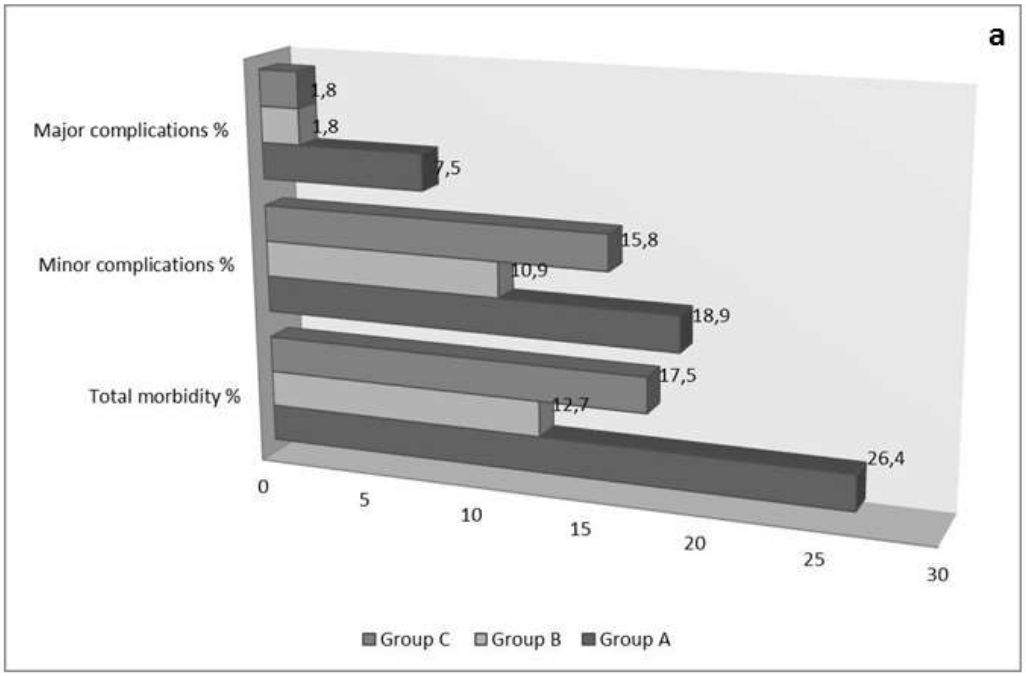
Re-resections excluded

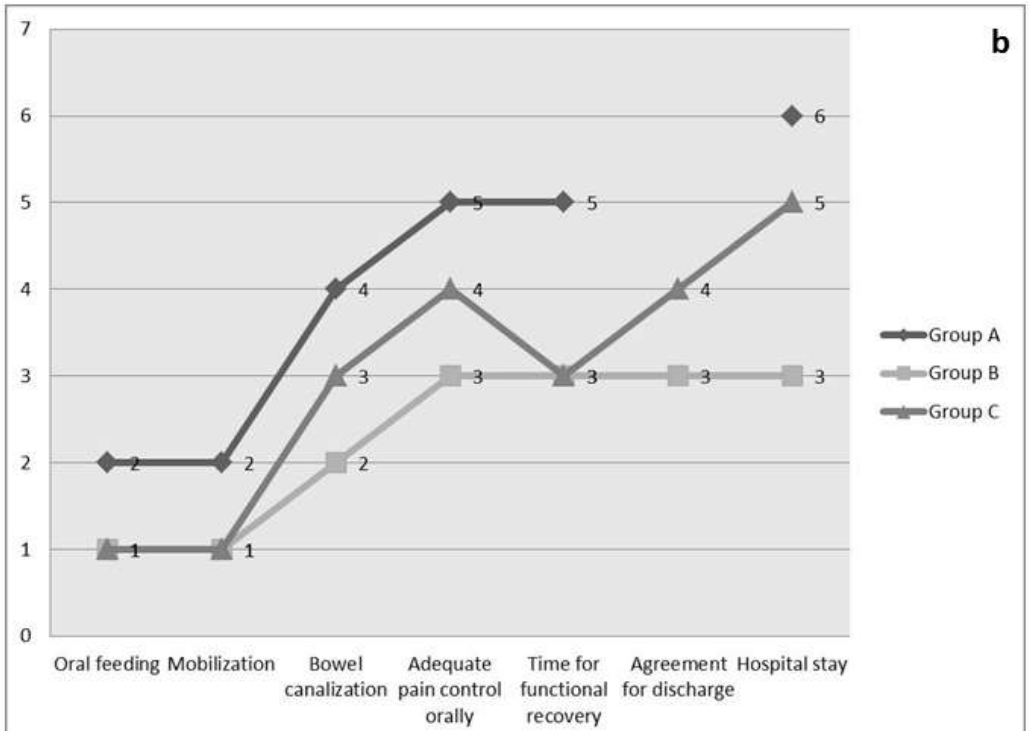
207 minor resections

Stratified in 3 groups:

- Open pre-ERAS
- Laparoscopic
- Open ERAS

Group A: Open pre-ERAS (95 patients)	vs	***Group B:*** Laparoscopic (55 patients)	vs	***Group C:*** Open ERAS (57 patients)





Outcome of patients undergoing liver resection for HCC at OSR

- ✓ Gruppo A: Resections Open pre-ERAS
- ✓ Gruppo B: Resections LPS
- ✓ Gruppo C: Resections Open ERAS

Digestive Liver Disease, 2016

The clinical and biological impacts of the implementation of fast-track perioperative programs in complex liver resections: A propensity score-based analysis between the open and laparoscopic approaches

Ratti F, Cipriani F, Reineke R, Comotti L, Paganelli M, Catena M, Beretta L, Aldrighetti L.

Laparoscopy is the natural field for a wide implementation of ERAS protocols themselves.

Variable, n(%)	LPS Group (n=102)	Open Group (n=102)	P
Preoperative counselling	85 (83.3)	79 (77.4)	NS
Minimal preoperative fastening	100 (98)	98 (96.1)	NS
No bowel preparation	99 (97.1)	98 (96.1)	NS
Preop drink intake	94 (92.2)	93 (91.2)	NS
No premedication	99 (97.1)	94 (92.2)	NS
Thoracic epidural anesthesia	67 (65.7)	83 (81.4)	0.043
Avoidance of morphin	97 (95.1)	89 (87.2)	0.044
Prevention of hypothermia	102 (100)	102 (100)	NS
SVV monitoring	84 (82.4)	77 (75.5)	0.048
No abdominal drain	65 (63.7)	61 (59.8)	NS
No NG tube	102 (100)	102 (100)	NS
Early liquid intake (POD 0-1)	102 (100)	100 (98)	NS
Early mobilization (POD 0-1)	98 (96.1)	89 (87.2)	0.033
PONV prophylaxis	94 (92.2)	98 (96.1)	NS
Antithrombotic prophylaxis	96 (94.1)	94 (92.2)	NS
Antibiotic prophylaxis	102 (100)	102 (100)	NS
I/R injury prevention	99 (97.1)	98 (96.1)	NS
Review discharge criteria	102 (100)	102 (100)	NS
Ileus prevention	51 (50)	60 (58.8)	0.049
Free fluids/normal diet POD1	75 (73.5)	55 (53.9)	0.028
IN fluids discontinued POD2	69 (67.6)	41 (40.2)	0.019
Oral analgesia POD2	71 (69.6)	21 (20.6)	0.001
Normal diet POD2	100 (98)	95 (93.1)	NS
Removal urinary catheter POD2	85 (83.3)	63 (61.8)	0.027
Full mobilization POD3	102 (100)	90 (88.2)	0.029
Discharge POD3-4	76 (74.5)	50 (49)	0.015

83.3% of patients in the LPS and 77.4% in the Open group respected more than 20 ERAS items

Surgery 2018

Abbreviations: SVV, Stroke Volume Variation; NG, Naso Gastric; POD, Post Operative Day; I/R, Ischemia Riperfusion

LPS approach

Mini-invasiveness
Easy application of FAST track

Implementation of laparoscopic programs

ERAS

Favourable biological scenario

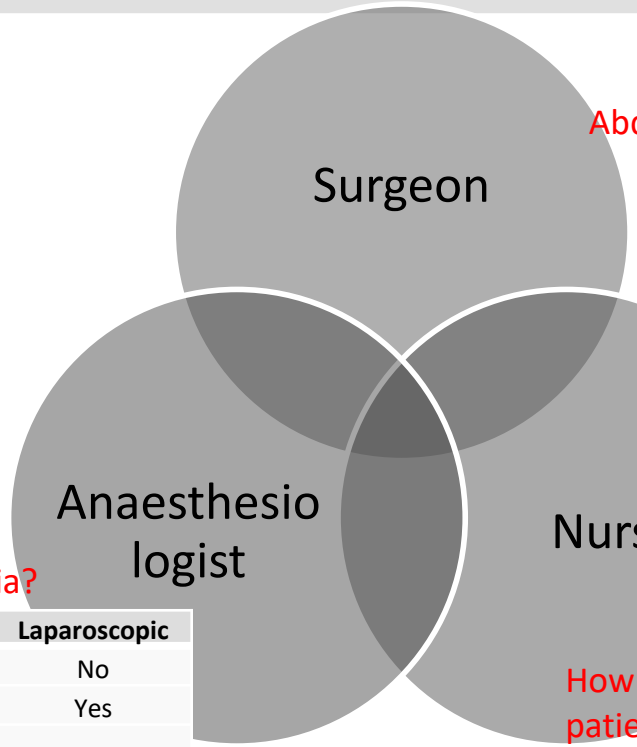
- ✓ Less impact on inflammatory profile and coagulation
- ✓ Reduced morbidity
- ✓ Faster functional recovery

Open approach

«Maxi»-invasiveness
«Hard» application of FAST track

Implementation of fast-track programs in candidates unsuitable for laparoscopy

1 Team building (specific skills for specific issues)



Abdominal drainage, when?

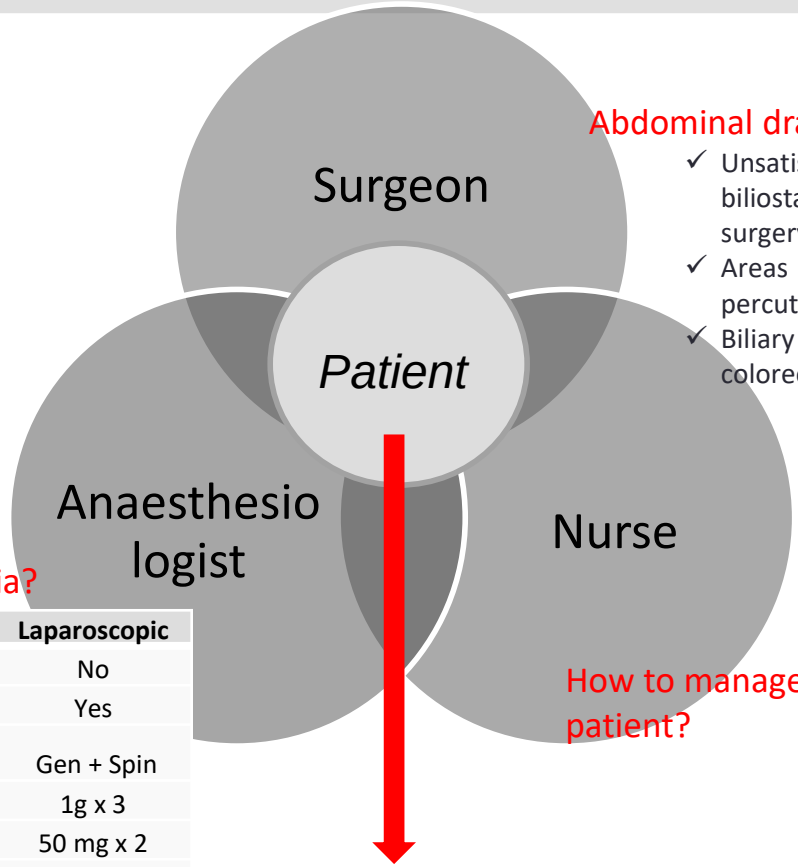
- ✓ Unsatisfactory biliostasis/haemostasis Redo surgery
- ✓ Areas not easily accessible by percutaneous drainage
- ✓ Biliary enteric anastomosis or colorectal anastomosis

How to manage pain and volemia?

	Minor Open	Major Open	Laparoscopic
CVC	No	No	No
Vigileo	Yes	Yes	Yes
Anaesthesia	Gen + Peri or Gen + Spin	Gen + PVT	Gen + Spin
Paracetamol	1g x 3	1g x 3	1g x 3
Tapentadol	50 mg x 2 (if spinal)	No	50 mg x 2
NSAID	Ketorolac 30 mg ab	Ketorolac 30 mg ab	Ketorolac 30 mg ab

How to manage the contact with the patient?

1 Team building (specific skills for specific issues)



Abdominal drainage, when?

- ✓ Unsatisfactory biliostasis/haemostasis Redo surgery
- ✓ Areas not easily accessible by percutaneous drainage
- ✓ Biliary enteric anastomosis or colorectal anastomosis

How to manage pain and volemia?

	Minor Open	Major Open	Laparoscopic
CVC	No	No	No
Vigileo	Yes	Yes	Yes
Anaesthesia	Gen + Peri or Gen + Spin	Gen + PVT	Gen + Spin
Paracetamol	1g x 3	1g x 3	1g x 3
Tapentadol	50 mg x 2 (if spinal)	No	50 mg x 2
NSAID	Ketorolac 30 mg ab	Ketorolac 30 mg ab	Ketorolac 30 mg ab

How to manage the contact with the patient?

Compliance

How to implement ERAS programs?

1. Team building (specific skills for specific issues)
2. Prospective development of the protocol (periodic internal discussion)

2011
- ***Version 1.0***
- Protocol developed from international trials
- Surgeon + anaesthesiologist

2014
- ***Version 2.0***
- Protocol revised according to team experience
- Surgeon + anaesthesiologist + nurse

2016
- ***Version 3.0***
- Protocol revised according to team experience, prospective data and guidelines
- Involved physiotherapists and psycologists

2018
- **Version Hyper**
- Selected patients

2019
- Version 4.0
- Navigator nurse implementation
- Steroids adjusted on patient weight
- Preoperative FKT

How to implement ERAS programs?

1. Team building (specific skills for specific issues
2. Prospective development of the protocol (periodic internal discussion)
3. Internal audit

How to implement ERAS programs?

1. Team building (specific skills for specific issues
2. Prospective development of the protocol (periodic internal discussion)
3. Internal audit
4. International multi-institutional trials

Randomized clinical trial

Randomized clinical trial of open *versus* laparoscopic left lateral hepatic sectionectomy within an enhanced recovery after surgery programme (ORANGE II study)

E. M. Wong-Lun-Hing[1,2], R. M. van Dam[1,13], G. J. P. van Breukelen[3,4], P. J. Tanis[6], F. Ratti[14], R. van Hillegersberg[7], G. D. Slooter[8], J. H. W. de Wilt[9], M. S. L. Liem[10], M. T. de Boer[11], J. M. Klaase[12], U. P. Neumann[1,13], L. A. Aldrighetti[14] and C. H. C. Dejong[1,2,5,13], on behalf of the ORANGE II Collaborative Group*

Specific effect of ERAS: PROCEDURES (Left lateral sectionectomy)

Randomized clinical trial

Randomized clinical trial of open *versus* laparoscopic left lateral hepatic sectionectomy within an enhanced recovery after surgery programme (ORANGE II study)

Br J Surg 2016

E. M. Wong-Lun-Hing[1,2], R. M. van Dam[1,13], G. J. P. van Breukelen[3,4], P. J. Tanis[6], F. Ratti[14], R. van Hillegersberg[7], G. D. Slooter[8], J. H. W. de Wilt[9], M. S. L. Liem[10], M. T. de Boer[11], J. M. Klaase[12], U. P. Neumann[1,13], L. A. Aldrighetti[14] and C. H. C. Dejong[1,2,5,13], on behalf of the ORANGE II Collaborative Group*

	RCT			Registry		
	OLLS ($n = 11$)	LLLS ($n = 13$)	P‡	ONR ($n = 13$)	LNR ($n = 54$)	P‡
Functional recovery (days)	3 (3–5)	3 (3–3)	0·284	3 (3–3)	3 (3–4)	0·529
Adequate pain control with oral analgesia only	3 (2–3)	3 (2–3)	0·539	3 (3–4)	2 (2–3)	0·017
Independent mobility or preoperative level	3 (3–4)	3 (2–3)	0·071	3 (3–4)	3 (2–3)	0·240
No intravenous fluid	2·5 (2–3)¶	2 (1–3)¶	0·273	2 (1–4)	2 (1–2)	0·308
Tolerance of solid food	1 (1–1)	1 (1–1)	0·738	2 (1–2)	1 (1–1)	0·002
Normal or decreasing serum bilirubin level	2·5 (1–3)	1 (1–3)	0·232	0 (0–1)	1 (0–2)	0·161
Postoperative milestones (days)						
Free oral fluids	0 (0–1)	0 (0–0)	0·563	1 (0–1)	1 (0–1)	0·202
Removal of indwelling urinary catheter	3 (2–3)	2·5 (1–3)	0·140	3 (3–6)	2 (1–3)	0·031
First flatus	1 (1–2)	1 (1–2)	0·446	2 (1–3)	2 (1–2)	0·076
First stool	3 (2–4)¶	2 (2–3)¶	0·307	3 (3–4)¶	2 (2–3)¶	0·138
LOS (days)	4·5 (4–6)	4 (3–5)	0·049	5 (4–7)	4 (3–5)	0·064
Difference (LOS – functional recovery) (days)	1 (0–3)	1 (1–2)	0·832	2 (1–3)	1 (0–2)	0·042
Delay in discharge*†	8 of 10 (80)	9 (69)	1·000§	11 (85)	23 (43)	0·090§
Reasons for delay in discharge*						
Logistical	2 of 10 (20)	5 (38)		6 (46)	11 (20)	
Medical	3 of 10 (30)	1 (8)		2 (15)	5 (9)	
Patient preference	2 of 10 (20)	2 (15)		0 (0)	2 (4)	
Unknown	1 of 10 (10)	1 (8)		3 (23)	15 (28)	

Specific effect of ERAS: PROCEDURES (Major resections)

ORANGE II PLUS Trial

An international multicentre randomised controlled trial of open versus laparoscopic hemihepatectomy within an ERAS programme

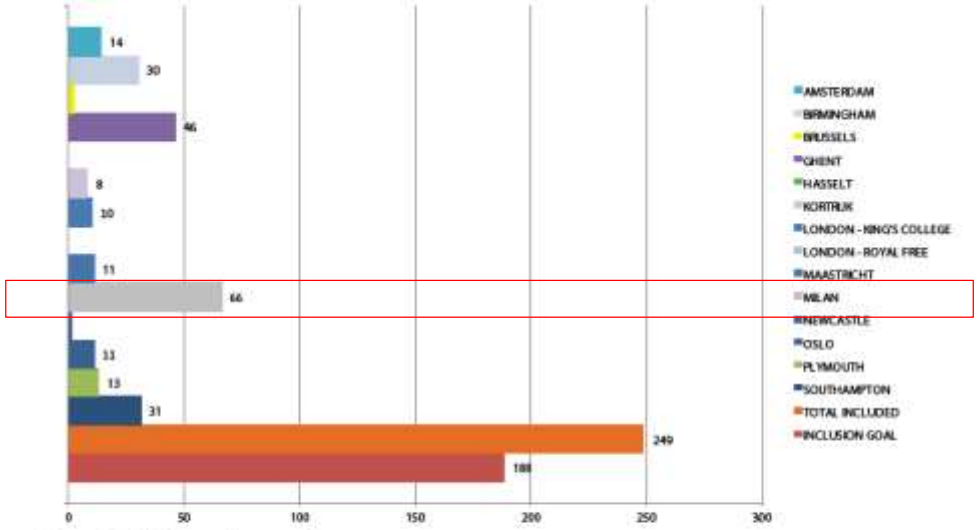


Figure 3 - trial accrual per centre.
Milan , Ghent, Southampton and Birmingham are responsible for the majority of the inclusions.

1. *Milan - 66 randomisations*
2. *Ghent - 46 randomisations*
3. *Southampton - 31 randomisations4*
4. *Birmingham - 30 randomisations*

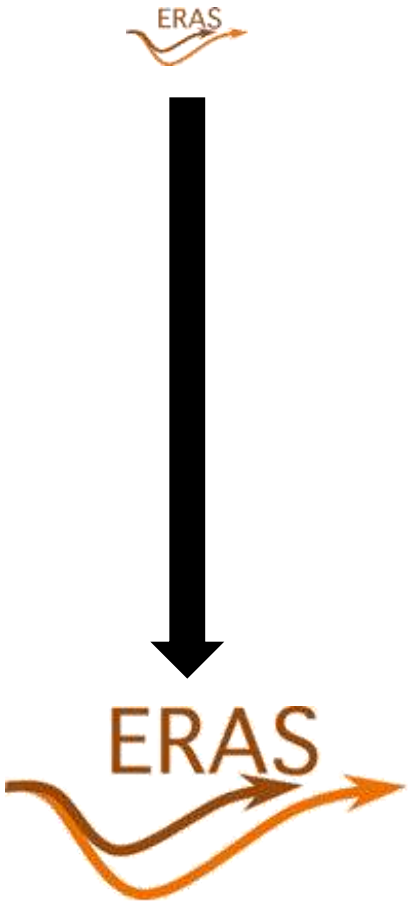
Centres started

15

Patients included in RCT

249/250

How to implement ERAS programs?



1. Team building (specific skills for specific issues
2. Prospective development of the protocol (periodic internal discussion)
3. Internal audit
4. International multi-institutional trials
5. Prospective collection of data