



What is ERAS? Enhanced Recovery After Surgery

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ERAS = "Fast-track" surgery



“An interdisciplinary multimodal concept to accelerate postoperative convalescence, reduce general morbidity and hospital stay for the patients with major abdominal operations.”

Kehlet H (1995)



ERAS Group

- Best practice in perioperative care:
 - **colon resection,**
 - **rectal, liver, pancreatic, gastric resection**
- **Aims: Enhancing recovery and reducing morbidity and hospital length of stay(LOS)**
- **Means: Reducing the surgical stress and organ dysfunction**

Evidence Based Protocol



Surgical stress

- **Pain**
- **Catabolism**
- **Nausea/vomiting**
- **Ileus**
- **Fluid homeostasis alteration**
- **Impaired pulmonary functions**
- **Increased cardiac demands**
- **Coagulation dysfunction**
- **Sleep disturbance and fatigue**



Multiprofessional approach

All in board – the same view – the same protocol

- **Doctors**
- **Nurses**
- **Physiotherapists**
- **Social workers**
- **High Dependency Unit**
- **Ward**



ERAS

Making radical changes

Surgeon:

No bowel prep

Food after surgery

No drains or KAD

No iv fluids, no lines

Early discharge

Anesthetist:

CHO not fasting

No premedication

EDA

Balanced fluids

No or short acting
opioids

All evidence based!

Preoperative Components



- **Education**
- **Stabilize coexisting diseases**
- **Optimize comfort (minimize anxiety)**
- **Ensure hydration, electrolyte, normothermia**
- **Appropriate use of prophylactic therapy (nausea, ileus, pain, antibiotic)**



Intraoperative Components

- **Multimodal anesthesia to optimize surgery and recovery**
- **Local anesthesia/analgesia (or thoracic epidural) if possible**
- **Laparoscopic surgery if possible**

Postoperative Components



- **Remove NG tube**
- **Start oral feedings early**
- **Minimize opioids**
- **Early mobilisation**

Preoperative CHO drink

Patients should receive CHO loading preoperatively
(Grade A)

Oral CHO drink (12.5%), 800 ml the night before and 200 ml 2 hs preop

- preop anxiolysis
- ↓ postop insulin resistance
- fastens recovery

Preoperative fasting for solid: 6hs

The duration of preoperative fasting should be 2 hours for liquids and 6 hours for solids (Grade A)

Mechanical Bowel Preparation (MBP)



In elective colonic resection MBP is not necessary (grade A)
MBP may be considered for low rectal surgery and perop.colonoscopy

- Dehydration before surgery
- Overnight fasting → further dehydration
- Increased risk for excess fluid treatment
- Metaanalysis with 15 RCT (5000 patients):
 - cardiac events 4%(MBP+) vs 2,5% (MBP-):
 - no difference in septic complications, ileus, anastomotic leak, mortality



ERAS protocol

- **Antimicrobial prophylaxis**
- **Thromboprophylaxis**
- **Perioperative oxygen therapy**
- **Preventing hypothermia**

Protocol: Postoperative Pain

Multimodal analgesia



ERAS Preop:

EDA Placement: Th 8-9
Activate before surgery

ERAS Perop:

If opioids - short acting
Local instillation

ERAS Postop:

Continuos EDA for 48h
(grade A)
Avoid opioids
Paracetamol
Cox 2 inhibitors / NSAID

Protocol: Fluids



- Perioperative fluid restriction with avoidance of hipovolemia is safe (grade A)
- Hipervolemia: ileus, impair wound healing, ↑LOS

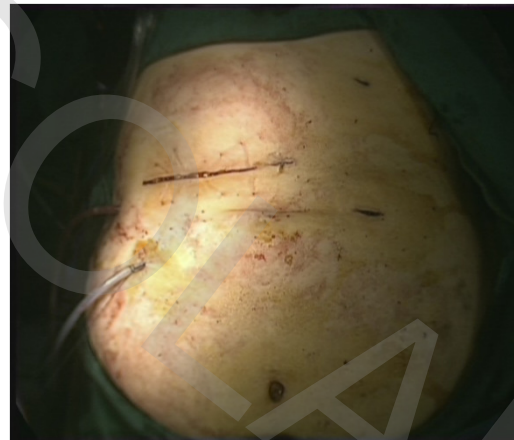
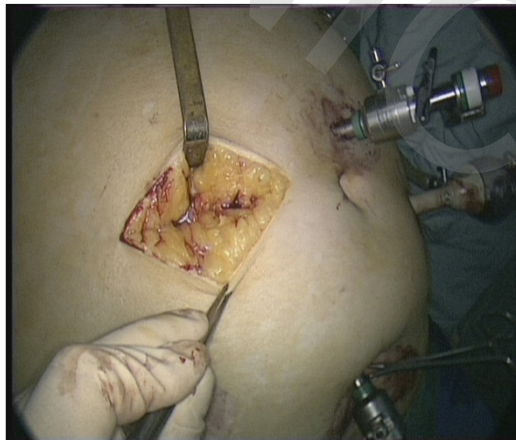
Perop: 1,000 ml Balanced salt solution
500 - 1000 ml HES colloid

Postop: 500-1000ml iv
Oral fluids 800 ml

Day 1: Oral fluid and food

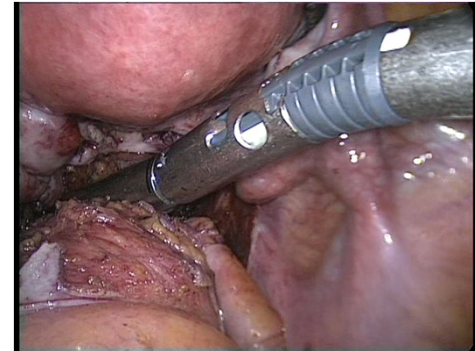
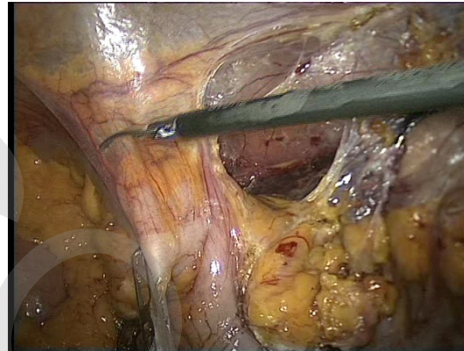
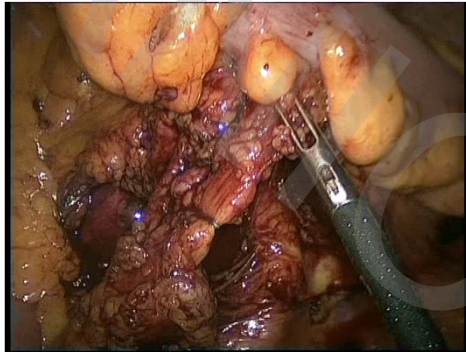
Surgical incisions: a midline or transvers incision of minimal length should be used

Transvers incisions cause less pain and pulmonary dysfunction.

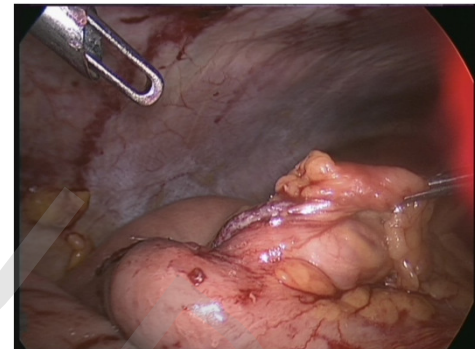
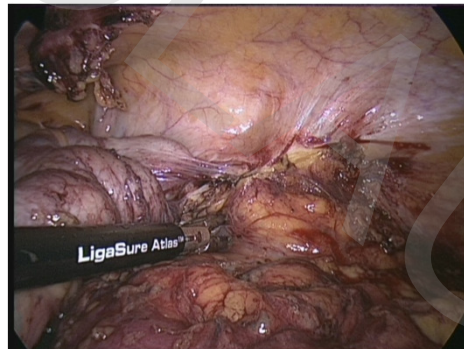
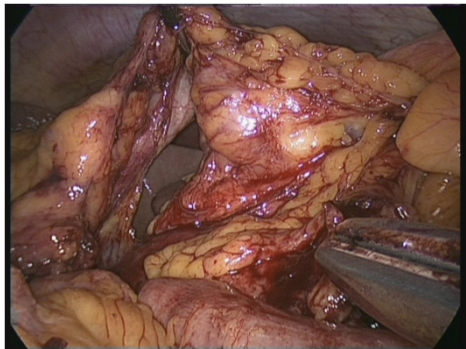


Drainage: drains are not indicated following routine colonic resection above the peritoneal reflection (grade A)

Laparoscopy-assisted surgery:
is recommended if the surgeon or department
proficient with the technique (Grade A)



Laparoscopic assisted left hemicolectomy



Laparoscopic assisted right hemicolectomy

**Laparoscopy assisted colonic resection
improves the short-term outcomes**

RCT ERAS protocol : laparoscopic assisted vs open operations

Table 2 Demographics, patient characteristics, and results of the included studies.

References	N Lap/ Open	Age (years) Lap/ Open	% ASA I&II Lap/ Open	Type of surgery	PHS (days) Lap/ Open	OHS (days) Lap/ Open	Readmissions % (n) Lap/Open	Morbidity % (n) Lap/Open	Mortality % (n) Lap/Open
RCTs									
Basse <i>et al.</i> [28]	30/30	75.5/75	83/63	RH, SR	2 (range 2-20)/2 (range 2-5)	2 (NR)/2 (NR)	20 (6)/26.6 (8)	26.6 (8)/20 (6)	0/10 (3)
King <i>et al.</i> [30]	41/19	72.3/ 70.4 (mean)	78/84	LH, RH, SR, AR, APR	5 (IQR 3-6)/8 (IQR 5-9.25)*	6 (IQR 3-11)/8.5 (IQR 6-12.5)*	4.6 (2)/26.3 (5)*	14.9 (6)/26.3 (5)	2.4 (1)/5.3 (1)
CCTs									
MacKay <i>et al.</i> [31]	21/57	72.0/ 73.2	77/74	LH, RH, AR, HC	6 (IQR 5-9)/6 (IQR 6-10)	NR	0/3.4(2)	27.2 (6)/22.4 (13)	4.5 (1)/1.7 (1)
Junghans <i>et al.</i> [29]	100/ 47	65/67	67/ 51.1	SR, RR	4 (range 3-123)/6 (range 3-79)*	NR	NR	22 (22)/44.7 (21)*	0/0
Polle <i>et al.</i> [32]	29/26	46.4/ 50.4	100/ 100	SC, IR	4 (IQR 3-5.5)/4.5 (IQR 4-8.25)	4 (IQR 3-6.5)/5 (IQR 4-10.25)	10.3 (3)/11.5 (3)	31.0 (9)/23.1 (6)	0/0

* $P < 0.05$. Bold values indicate significance. Continuous data: median (IQR or range). NR, not reported; LH, left hemicolectomy; RH, right hemicolectomy; SC, subtotal colectomy; SR, sigmoid resection; RR, rectal resection; IR, ileocolic resection; AR, anterior resection; APR, abdominoperineal resection; HC, Hartmann closure; ASA, American Society of Anesthesiologists.



Postoperative Oral Intake

Patients should be encouraged to start oral diet at will after surgery (grade A)

- **Early feeding : ↓ insulin resistance, ↓ catabolism, ↓ morbidity, ↓ LOS, no risk for anastomotic leak**
- **starting 4 hours after surgery**
- **400 ml energy dense oral supplements day 0**



Nasogastric tubes

Should not be used routinely in postop. period (gradeA)

Should be inserted if ileus develops

Meta-analysis: 33 Studies (5240 patients)

- **Patients without routine NG tube use had:**
 - **Earlier return of bowel function ($P < 0.00001$)**
 - **↓ pulmonary complications ($P = 0.01$)**
 - **↓ LOS**

- **No difference in anastomotic leak between patients with vs without NG tubes**

PONV and ileus



Reducing PONV:

- **antiemetics**
- **serotonine antagonists**
- **glucocorticoids**
- **droperidol**

- **local intestinal inflammation**
- **inhibitory reflex from the site of injury**  **postop ileus**
- **opioids**

Average time to resolution of ileus after major abdominal surgery

- **Small intestine: 0-24 hours**
- **Stomach: 24-48 hours**
- **Colon: 48-120 hours**



Prevention of postoperative ileus: the key of ERAS protocol

- **Postoperative analgesia (EDA)**
- **Avoidance of fluid overload**
- **Laparoscopic approach if locally validated**
- **Low-dose laxative (magnesium oxide)**
- **Peripheral opioid-antagonists**



Early mobilisation

Patients should be out of bed for 2h on the day of surgery and for 6h per day until discharge

Bed rest increased insulin resistance and decreases muscle strength, pulmonary functions, and tissue oxygenation



Discharge

Discharge criteria

- **Good pain control on oral NSAIDS**
- **Oral solid food, no iv fluids required**
- **Independently mobile or same level as preop.**
- **Willing to go home**



Follow-up

Follow-up

- **Hotline (telephone) with hospital 24-48 hs**
- **Hospital visit at 7-10 days**
- **Late visit at 30 days**
- **Good cooperation with general practitioner**

Multinational survey in Europe and USA (295 hospitals, 1082 patients)

- **MBP: 94%** (86-97%)
- **Laparotomy: 63%** (F) – **98%** (UK)
- **NGT postop: 66%** (53-93%)
- **First drink normally: 3,5-5,3 days postop.**
- **Eat normally: 5,3-6,9 days postop.**
- **Preop. hosp.stay: 2,1-3,9 days** (Europe); **0,8 days** (USA)
- **LOS: 10,2-13,2 days** (Europe); **7 days** (USA)



Results of fast-track compared with traditional surgery

- ↓ duration of ileus
- ↑ muscle strength and exercise capacity
- ↑ oral energy and protein intake
- ↓ cardiopulmonary morbidity
- ↓ LOS
- ↓ period of postoperative convalescence
- ↓ costs (40%*, 56%**)
- no effect on rate of readmissions

*Schwenk W et al, Int J Colorectal Dis, 2007

**Bosio RM et al, Am J Surg, 2007

Kehlet H, Lancet, 2008

RCT: ERAS protocol vs traditional protocol (I)

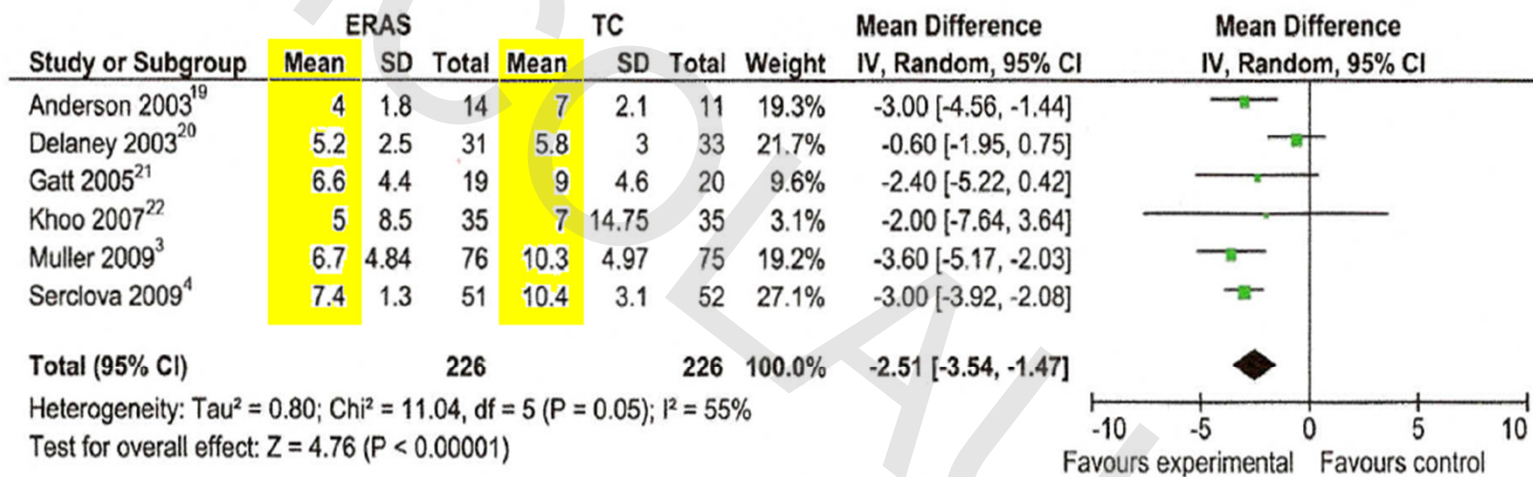


Fig. 2. Forest plot of comparison: Length of hospital stay (days). [ERAS = enhanced recovery after surgery (experimental group); TC = traditional care (control group)].

Varadhan KK, et al., The enhanced recovery after surgery (ERAS) pathway for patients undergoing major elective ..., *Clinical Nutrition* (2010), doi:10.1016/j.clnu.2010.01.004

RCT: ERAS protocol vs traditional protocol (II)

K.K. Varadhan et al. / Clinical Nutrition xxx (2010) 1–7

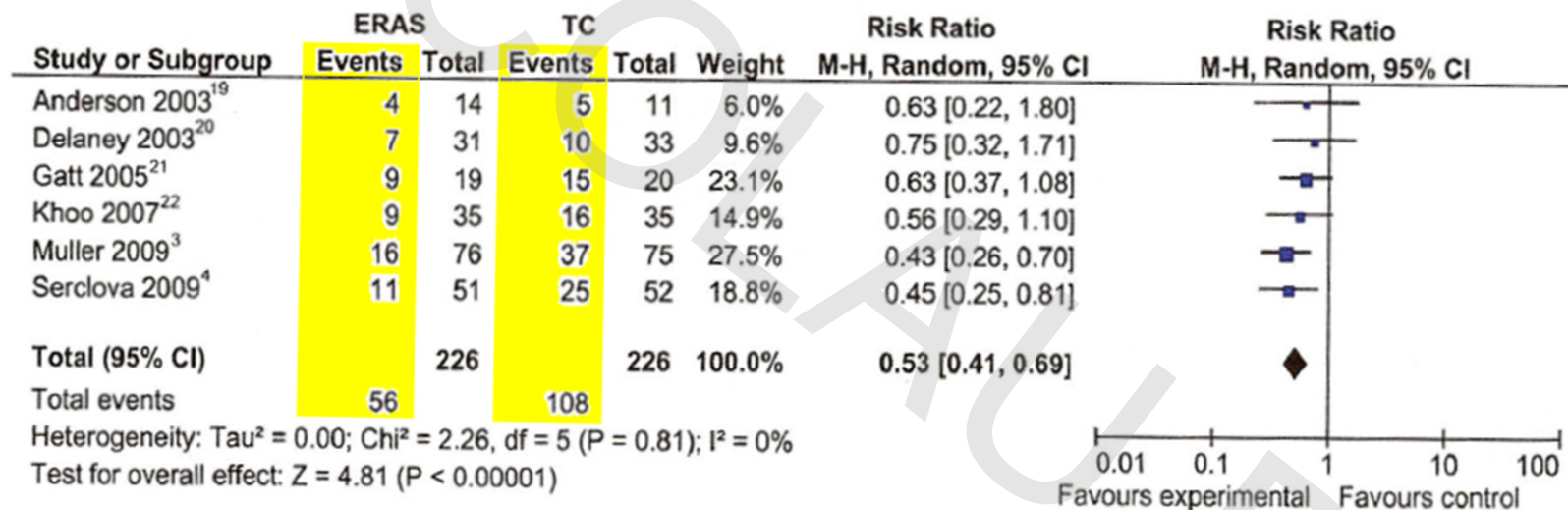


Fig. 3. Forest plot of comparison: Complications. [ERAS = enhanced recovery after surgery (experimental group); TC = traditional care (control group)].

Varadhan KK, et al., The enhanced recovery after surgery (ERAS) pathway for patients undergoing major elective ..., Clinical Nutrition (2010), doi:10.1016/j.clnu.2010.01.004

RCT: ERAS protocol vs traditional protocol (III)

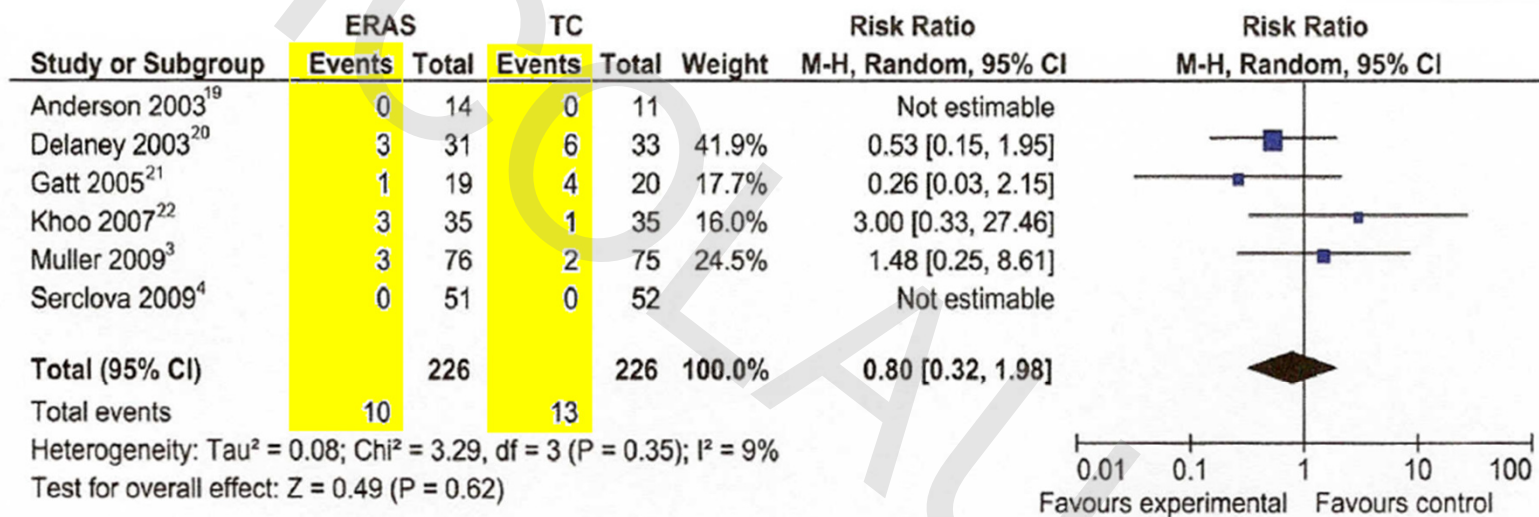


Fig. 4. Forest plot of comparison: Readmissions. [ERAS = enhanced recovery after surgery (experimental group); TC = traditional care (control group)].

Varadhan KK, et al., The enhanced recovery after surgery (ERAS) pathway for patients undergoing major elective ..., *Clinical Nutrition* (2010), doi:10.1016/j.clnu.2010.01.004

RCT: 96 patients

Table 4 Recovery parameters

	Group 1 (FT) (n = 48)	Group 2 (C) (n = 48)	<i>p</i> value
Time to complete mobilization (h)	19.6 ± 8.6	37.1 ± 23.9	0.001
Bowel function restoring (h)	43.7 ± 14.9	52.02 ± 23.7	0.042
Fluid intake: initiation of diet (h)	10.9 ± 8.06	23.54 ± 16.86	0.001
Solid food intake: normal diet (h)	42.17 ± 12.71	64.27 ± 23.25	0.01
PONV	17 (34.7)	21 (42.8)	0.538
Admission in HDU (days)	0.92 ± 1.11	1.77 ± 1.46	0.001
Hospitalization time (days)	6.43 ± 3.41	9.16 ± 2.67	0.001
Hospital readmission	0 (0)	0 (0)	NA

Data are means ± standard deviations or number of patients with percentages in parentheses unless otherwise indicated

Table 5 Surgical and nonsurgical complications in study groups

Complication	Group 1 (FT) (n = 48)	Group 2 (C) (n = 48)
Anastomotic leak*	1 (2.04)	1 (2.04)
Wound infection*	4 (8.16)	5 (10.2)
Pulmonary embolism*	0 (0)	1 (2.04)
Postoperative hemia*	0 (0)	1 (2.04)
Urinary tract infection*	0 (0)	3 (6.12)
Hematuria*	1 (2.04)	0 (0)

* $p > 0.05$

Data are number of patients with percentages in parentheses

Our preliminary data

Patients: 20, median age 58 years, 12 men

Type of operations:

- **9 open resection ; 11 laparoscopic assisted**
 - **4 right hemicolectomies (3 laparoscopic)**
 - **8 left hemicolectomies (5 laparoscopic)**
 - **8 rectosigmoidian resections (3 laparoscopic)**

- **12 predefined FT modalities**

exception: solid food from the first day, drains, early mobilisation, iv fluids in the first day postop

- **Median time until the first bowel movement: day**

- **Solid food intake: 90% starting in the 2nd day**

- **Liquid intake :100% started in the first operative day**

- **Complications: 2 anastomotic leakage, 4 wound infections**

- **Readmission: 1**

Limitation of ERAS



- Working team
- Implementation of the protocol
 - Germany:50% of hospitals involved in ERAS used ≤ 3 elements
 - Austria and Germany: LOS <7days reduced reimbursement(!DRG)
- Patients exclusions criteria:
 - Emergency surgery
 - ASA IV
 - Previous abdominal surgery
 - Metastatic colon tumors
 - Refusal to participate



Conclusions

- **ERAS is a multimodal perioperative approach aiming at promoting recovery after major colorectal surgery**
- **ERAS is both advantageous for the patient and for the hospital**
- **ERAS ↓ LOS and postoperative complications**
- **ERAS is spreading as standard of practice throughout Europe**

Mulțumesc pentru atenție!

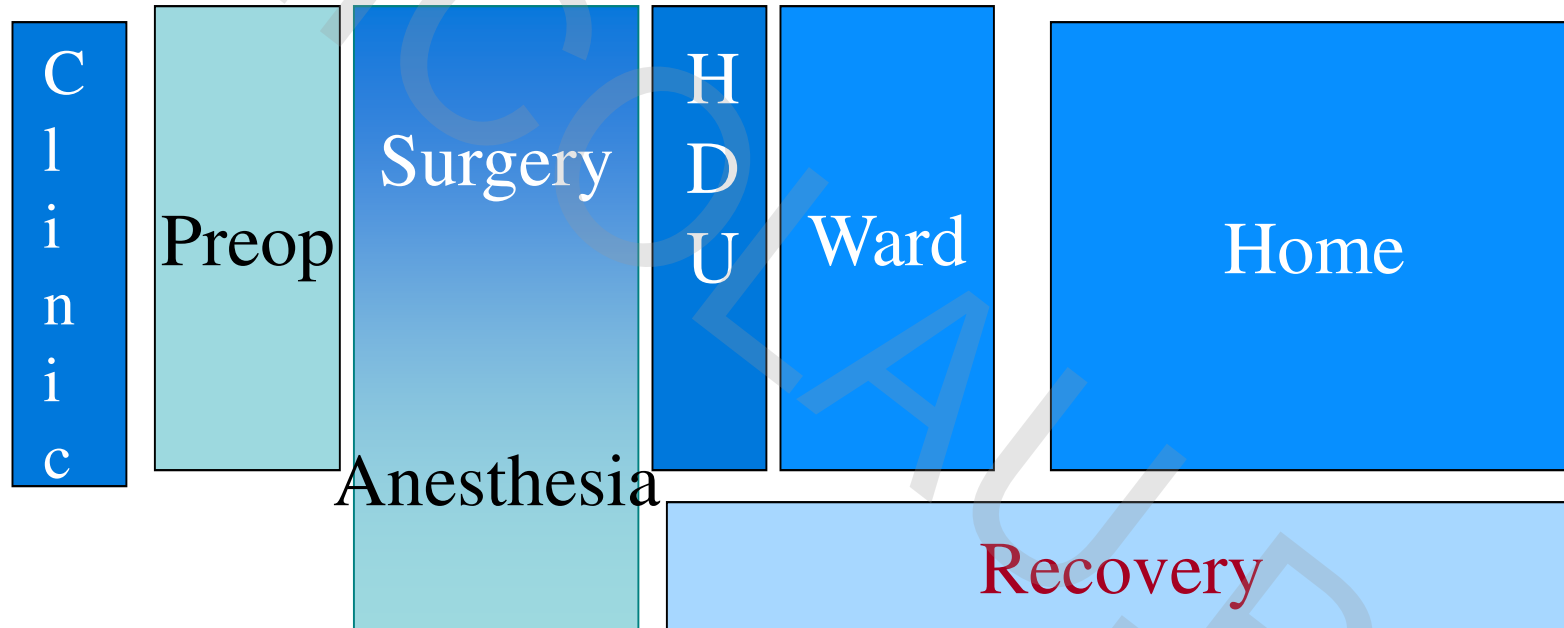




Conclusions

- **ERAS gives superior surgical results**
- **Compliance to protocol key to success**
- **Large scale improvements in care is achievable**
- **ERAS offers a model for improved care**

Enhanced Recovery After Surgery





Preoperative

- Education and counselling
- Careful assessment and medical optimization
- Nutritional and social support
- Carbohydrate loading
- Avoidance of prolonged preoperative fasting
- Avoidance of mechanical bowel preparation(MBA)

Early Oral/Enteral Nutrition Within 24

Meta-analysis of 13 RCT(1173 patients)

- **Data suggestive of reduced**
 - **Wound Infections**
 - **Pneumonia**
 - **Length of Stay**

- **Anastomotic Dehiscence – no influence**

**Conclusion: no benefit for restricting
postoperative oral/enteral nutrition**



Intraoperative

- Epidural anaesthesia (EDA)
- Short acting anaesthetic agents
- Prevention of hypothermia
- **Careful choice of incision/laparoscopy**
- Conservative fluid regime
- Prophylactic antiemetics and dexamethasone
- **Avoidance of drains/NGT**



Postoperative

- **Prophylactic antiemetics**
- **Early oral feeding with supplementation**
- **Opioid sparing analgesia/NSAIDs**
- **Early removal of urinary catheter**
- **Early mobilisation and physiotherapy**
- **Discharge criteria**



ERAS = "Fast-track" surgery

Multidisciplinary rehabilitation concept

What are trying to achieve?

Patient back to preoperative function

- **Normal gastrointestinal function**
- **Pain control**
- **Mobility**
- **No complication**

RCT: ERAS protocol vs traditional protocol (IV)

K.K. Varadhan et al. / Clinical Nutrition xxx (2010) 1-7

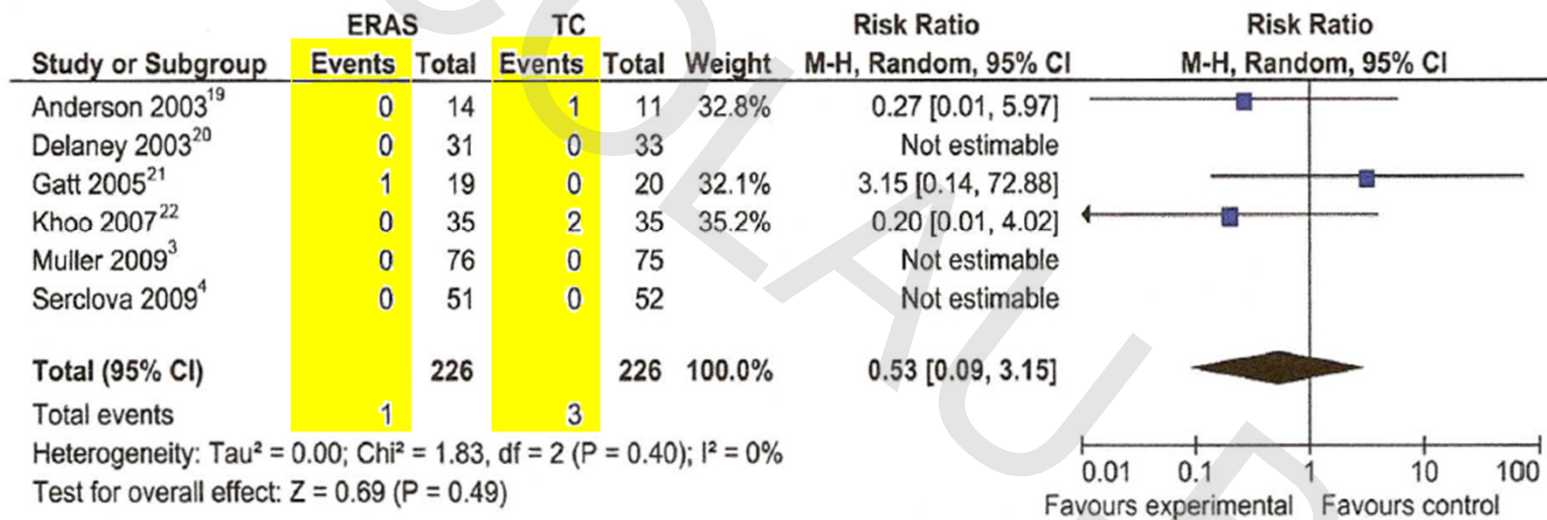
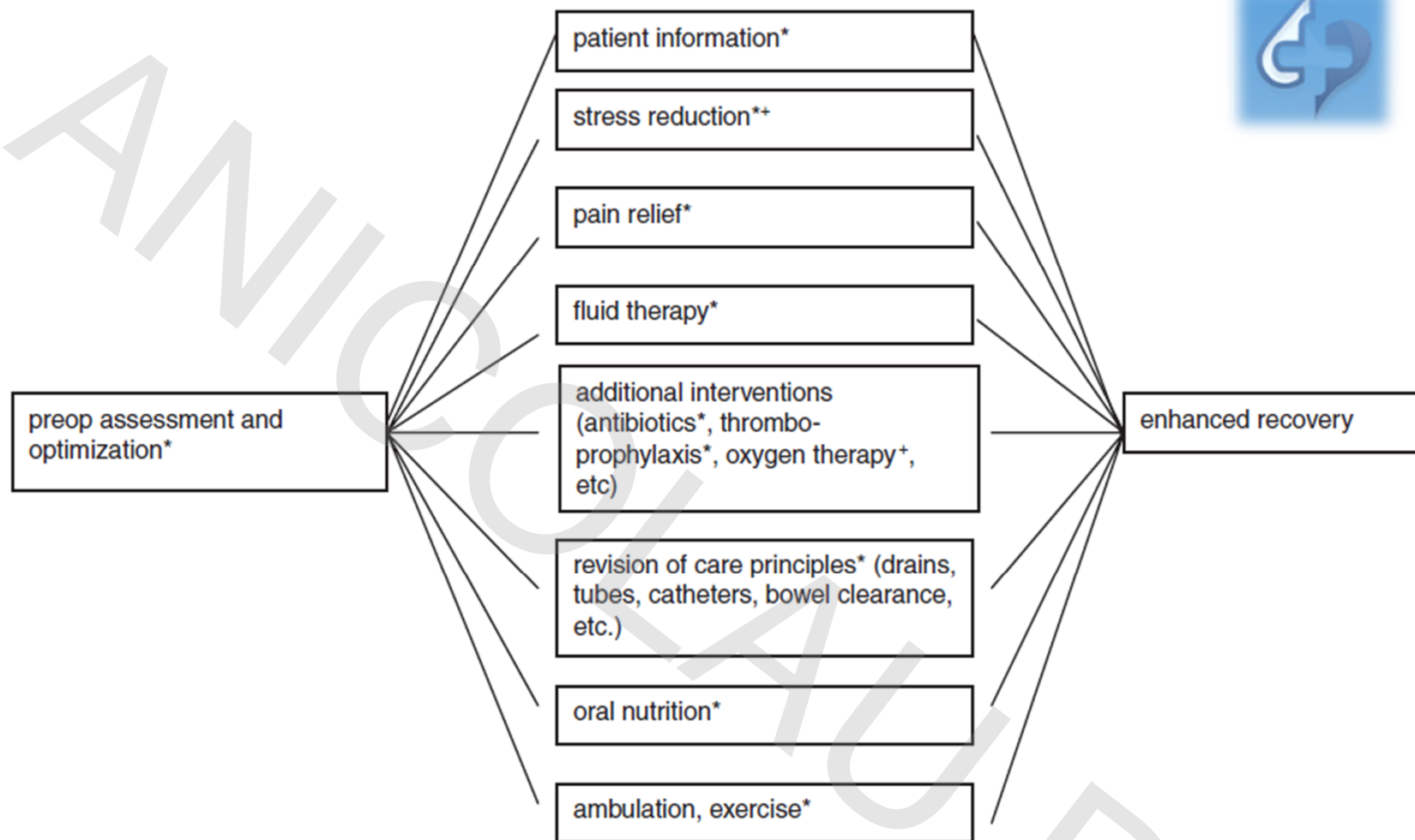


Fig. 5. Forest plot of comparison: Mortality. [ERAS = enhanced recovery after surgery (experimental group); TC = traditional care (control group)].

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Components of interventions to facilitate postoperative recovery (*, evidence available, ready for implementation, +, less evidence available, need for further study)