BaltAnestIC 2023
11th International Baltic Congress of Anaesthesioogy and Intensive care
September 28–30, 2023, Tartu, Estonia Estonian National Museum

"Outcomes"

Early postoperative nutrition improves outcome

PRO

September 29th, 2023 at 15.10-15.25

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CHUV Centre hospitalier universitaire vaudois

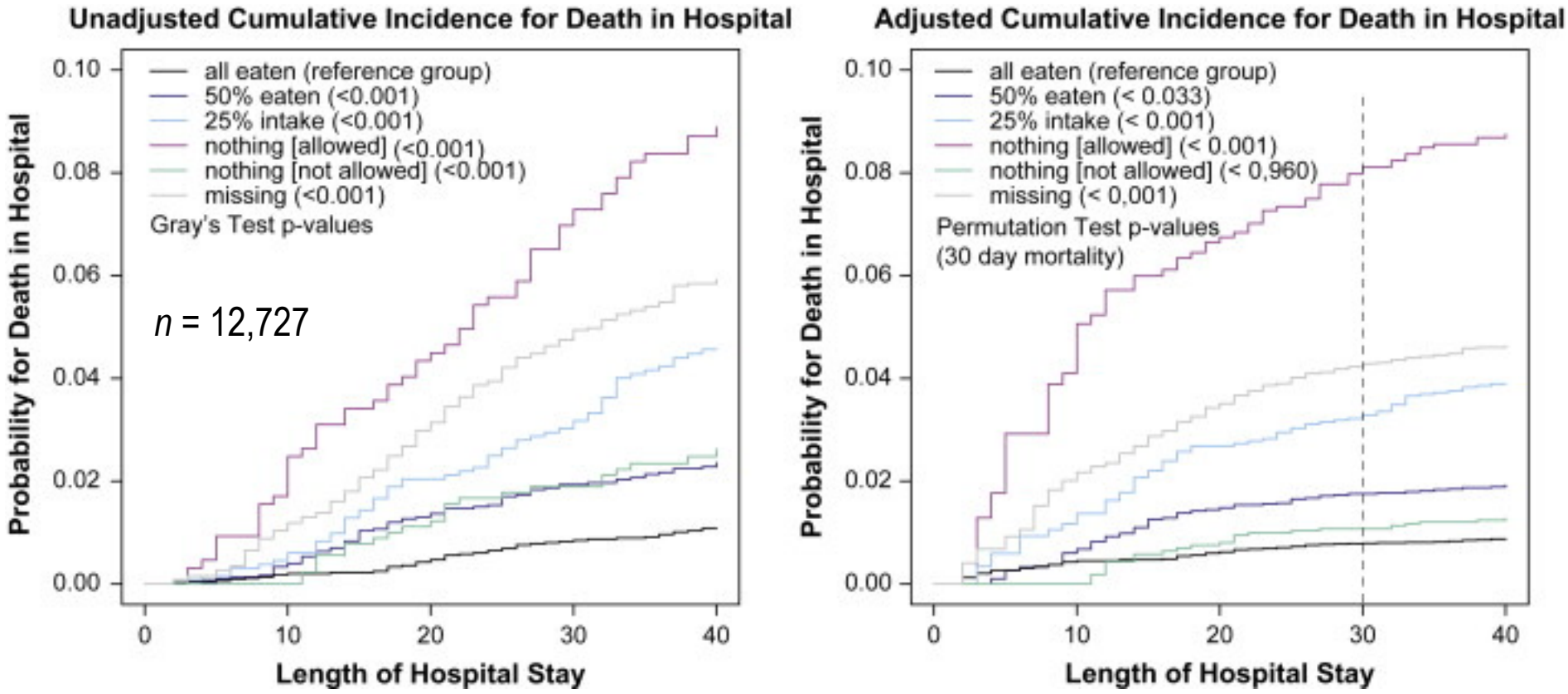
Berger Mette M – Disclosures - COI

Advisory Board/Consultant	Baxter, Fresenius Kabi
Stock shareholder, Bonds	none
Lecturer honoraria	Abbott, Aguettant, Baxter, DSM, Fresenius Kabi, Nestlé

Member of guideline groups :ESPEN ICU nutrition
ESICM ICU nutrition
ESPEN Micronutrients

Decreased food intake is a risk factor for mortality in hospitalised patients: The NutritionDay survey 2006

Hiesmayr et al, Clin Nutr 2009, 28:484

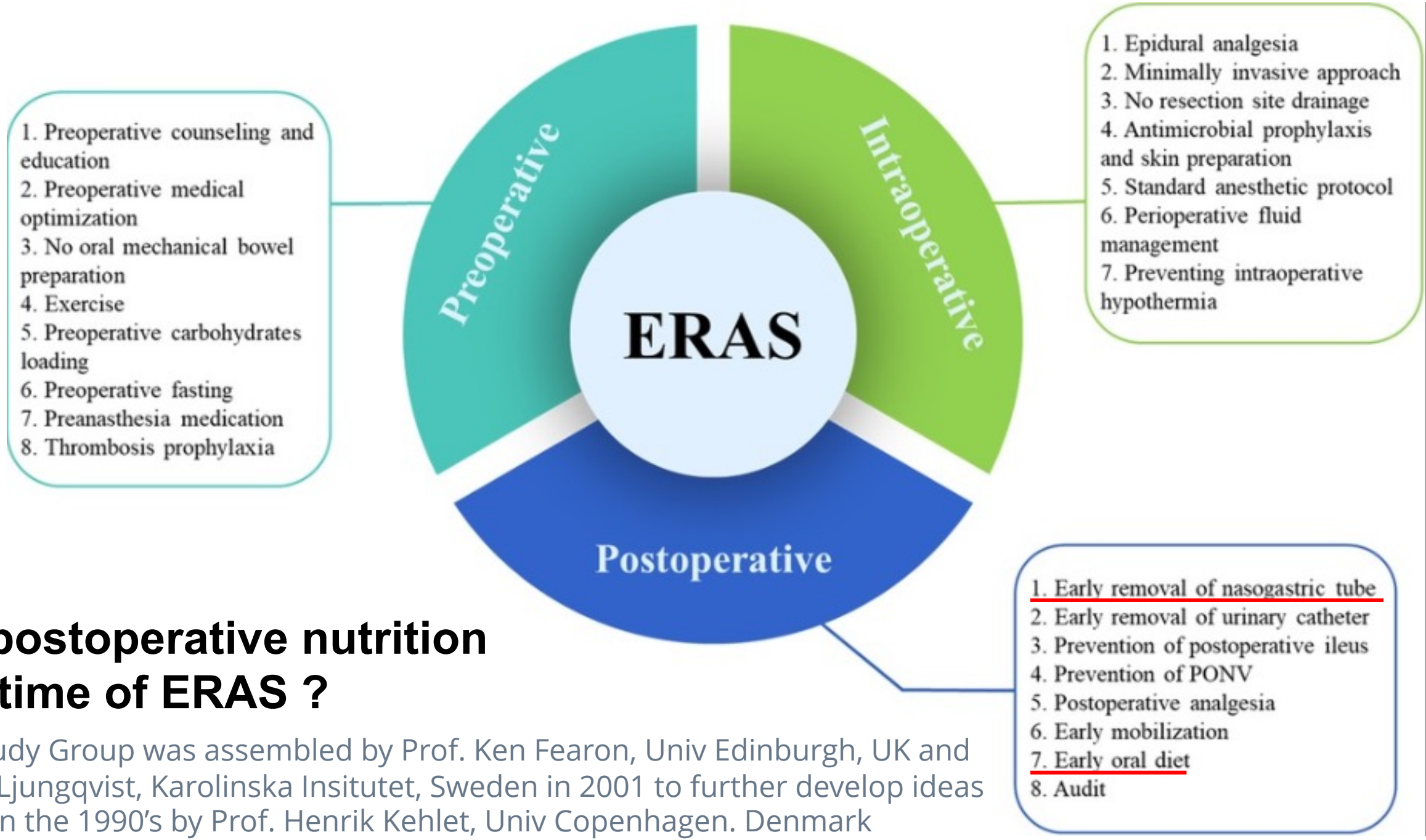


Unadjusted and adjusted cumulative incidence of death depending on food intake at lunch versus length of stay in hospital.

Adjustment is for length bias of the cross-sectional data collection and censoring at day 30 after inclusion,

Early postoperative – what does it mean??

What type of surgery?	Indication to medical nutrition
• Intra-cranial?	• Rare
• Ear-nose-throat?	• Often cancer & malnut
• Thoracic pulmonary?	• Often cancer & malnut
• Thoracic Cardiac?	• Nutri. often ok
• Major abdominal visceral?	• Nutri. status variable
• Abdominal vascular?	• Status often ok
• Limbs?	• Status often ok
• Spine?	• Status often ok

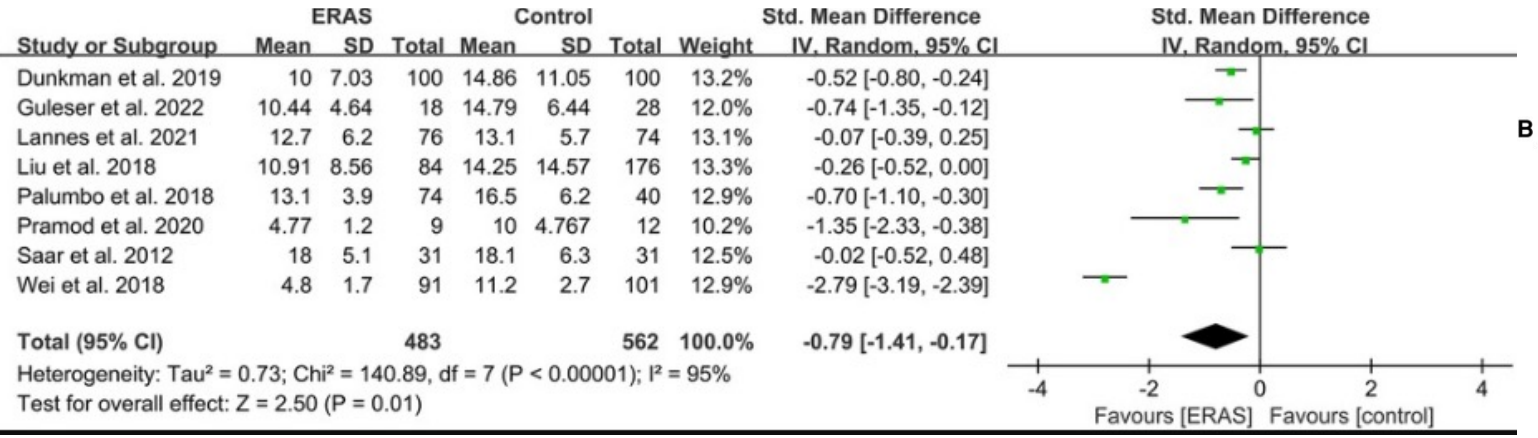


Early postoperative nutrition at the time of ERAS ?

ERAS® Study Group was assembled by Prof. Ken Fearon, Univ Edinburgh, UK and Prof. Olle Ljungqvist, Karolinska Insitutet, Sweden in 2001 to further develop ideas put forth in the 1990's by Prof. Henrik Kehlet, Univ Copenhagen. Denmark

The effect of the enhanced recovery after surgery program on radical cystectomy: a meta-analysis and systematic review

Zhou et al, Front. Surg 2023



Study or Subgroup	ERAS Mean	ERAS SD	ERAS Total	Control Mean	Control SD	Control Total	Weight	Std. Mean Difference IV, Random, 95% CI
Dunkman et al. 2019	10	7.03	100	14.86	11.05	100	13.2%	-0.52 [-0.80, -0.24]
Guleser et al. 2022	10.44	4.64	18	14.79	6.44	28	12.0%	-0.74 [-1.35, -0.12]
Lannes et al. 2021	12.7	6.2	76	13.1	5.7	74	13.1%	-0.07 [-0.39, 0.25]
Liu et al. 2018	10.91	8.56	84	14.25	14.57	176	13.3%	-0.26 [-0.52, 0.00]
Palumbo et al. 2018	13.1	3.9	74	16.5	6.2	40	12.9%	-0.70 [-1.10, -0.30]
Pramod et al. 2020	4.77	1.2	9	10	4.767	12	10.2%	-1.35 [-2.33, -0.38]
Saar et al. 2012	18	5.1	31	18.1	6.3	31	12.5%	-0.02 [-0.52, 0.48]
Wei et al. 2018	4.8	1.7	91	11.2	2.7	101	12.9%	-2.79 [-3.19, -2.39]
Total (95% CI)			**483**			**562**	**100.0%**	**-0.79 [-1.41, -0.17]**

Heterogeneity: Tau² = 0.73; Chi² = 140.89, df = 7 (P < 0.00001); I² = 95%
Test for overall effect: Z = 2.50 (P = 0.01)

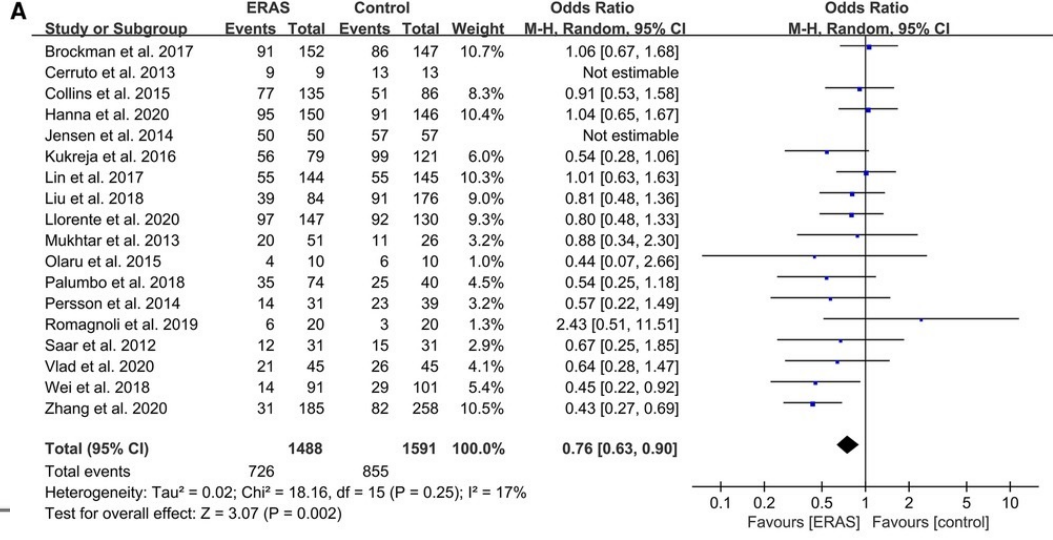
Std. Mean Difference IV, Random, 95% CI

-4 -2 0 2 4

Favours [ERAS] Favours [control]

Meta-analysis of length of stay (LOS)

Postoperative complications between the ERAS and control group.
(A)Overall complication;
(B)Intestinal obstruction;
(C) Urine leakage



A

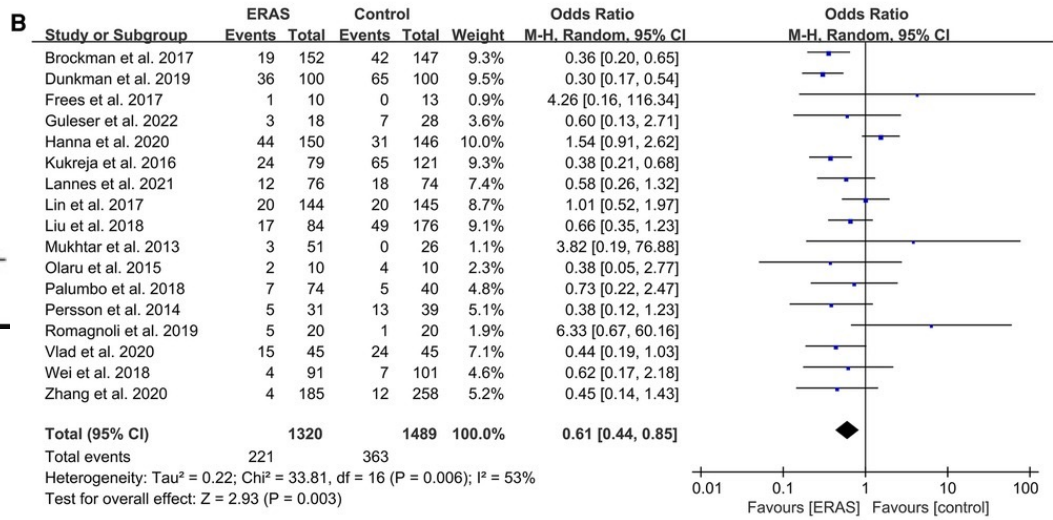
Study or Subgroup	ERAS Events	ERAS Total	Control Events	Control Total	Weight	Odds Ratio M-H, Random, 95% CI
Brockman et al. 2017	91	152	86	147	10.7%	1.06 [0.67, 1.68]
Cerruto et al. 2013	9	9	13	13		Not estimable
Collins et al. 2015	77	135	51	86	8.3%	0.91 [0.53, 1.58]
Hanna et al. 2020	95	150	91	146	10.4%	1.04 [0.65, 1.67]
Jensen et al. 2014	50	50	57	57		Not estimable
Kukreja et al. 2016	56	79	99	121	6.0%	0.54 [0.28, 1.06]
Lin et al. 2017	55	144	55	145	10.3%	1.01 [0.63, 1.63]
Liu et al. 2018	39	84	91	176	9.0%	0.81 [0.48, 1.36]
Llorente et al. 2020	97	147	92	130	9.3%	0.80 [0.48, 1.33]
Mukhtar et al. 2013	20	51	11	26	3.2%	0.88 [0.34, 2.30]
Olaru et al. 2015	4	10	6	10	1.0%	0.44 [0.07, 2.66]
Palumbo et al. 2018	35	74	25	40	4.5%	0.54 [0.25, 1.18]
Persson et al. 2014	14	31	23	39	3.2%	0.57 [0.22, 1.49]
Romagnoli et al. 2019	6	20	3	20	1.3%	2.43 [0.51, 11.51]
Saar et al. 2012	12	31	15	31	2.9%	0.67 [0.25, 1.85]
Vlad et al. 2020	21	45	26	45	4.1%	0.64 [0.28, 1.47]
Wei et al. 2018	14	91	29	101	5.4%	0.45 [0.22, 0.92]
Zhang et al. 2020	31	185	82	258	10.5%	0.43 [0.27, 0.69]
Total (95% CI)		**1488**		**1591**	**100.0%**	**0.76 [0.63, 0.90]**
Total events	726		855			

Heterogeneity: Tau² = 0.02; Chi² = 18.16, df = 15 (P = 0.25); I² = 17%
Test for overall effect: Z = 3.07 (P = 0.002)

Odds Ratio M-H, Random, 95% CI

0.1 0.2 0.5 1 2 5 10

Favours [ERAS] Favours [control]



B

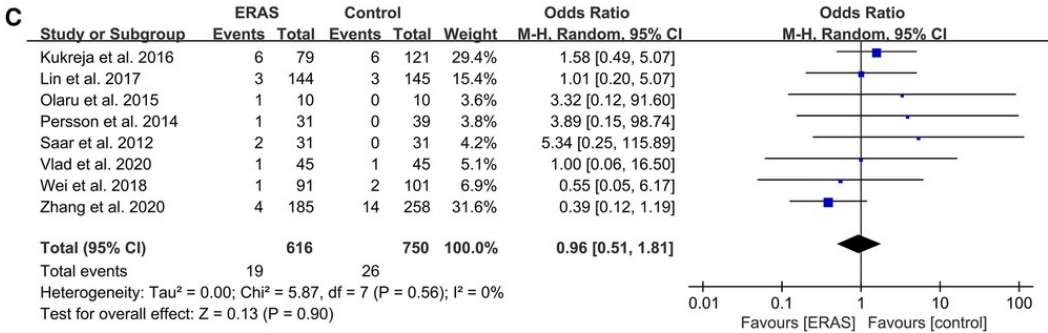
Study or Subgroup	ERAS Events	ERAS Total	Control Events	Control Total	Weight	Odds Ratio M-H, Random, 95% CI
Brockman et al. 2017	19	152	42	147	9.3%	0.36 [0.20, 0.65]
Dunkman et al. 2019	36	100	65	100	9.5%	0.30 [0.17, 0.54]
Frees et al. 2017	1	10	0	13	0.9%	4.26 [0.16, 116.34]
Guleser et al. 2022	3	18	7	28	3.6%	0.60 [0.13, 2.71]
Hanna et al. 2020	44	150	31	146	10.0%	1.54 [0.91, 2.62]
Kukreja et al. 2016	24	79	65	121	9.3%	0.38 [0.21, 0.68]
Lannes et al. 2021	12	76	18	74	7.4%	0.58 [0.26, 1.32]
Lin et al. 2017	20	144	20	145	8.7%	1.01 [0.52, 1.97]
Liu et al. 2018	17	84	49	176	9.1%	0.66 [0.35, 1.23]
Mukhtar et al. 2013	3	51	0	26	1.1%	3.82 [0.19, 76.88]
Olaru et al. 2015	2	10	4	10	2.3%	0.38 [0.05, 2.77]
Palumbo et al. 2018	7	74	5	40	4.8%	0.73 [0.22, 2.47]
Persson et al. 2014	5	31	13	39	5.1%	0.38 [0.12, 1.23]
Romagnoli et al. 2019	5	20	1	20	1.9%	6.33 [0.67, 60.16]
Vlad et al. 2020	15	45	24	45	7.1%	0.44 [0.19, 1.03]
Wei et al. 2018	4	91	7	101	4.6%	0.62 [0.17, 2.18]
Zhang et al. 2020	4	185	12	258	5.2%	0.45 [0.14, 1.43]
Total (95% CI)		**1320**		**1489**	**100.0%**	**0.61 [0.44, 0.85]**
Total events	221		363			

Heterogeneity: Tau² = 0.22; Chi² = 33.81, df = 16 (P = 0.006); I² = 53%
Test for overall effect: Z = 2.93 (P = 0.003)

Odds Ratio M-H, Random, 95% CI

0.01 0.1 1 10 100

Favours [ERAS] Favours [control]



C

Study or Subgroup	ERAS Events	ERAS Total	Control Events	Control Total	Weight	Odds Ratio M-H, Random, 95% CI
Kukreja et al. 2016	6	79	6	121	29.4%	1.58 [0.49, 5.07]
Lin et al. 2017	3	144	3	145	15.4%	1.01 [0.20, 5.07]
Olaru et al. 2015	1	10	0	10	3.6%	3.32 [0.12, 91.60]
Persson et al. 2014	1	31	0	39	3.8%	3.89 [0.15, 98.74]
Saar et al. 2012	2	31	0	31	4.2%	5.34 [0.25, 115.89]
Vlad et al. 2020	1	45	1	45	5.1%	1.00 [0.06, 16.50]
Wei et al. 2018	1	91	2	101	6.9%	0.55 [0.05, 6.17]
Zhang et al. 2020	4	185	14	258	31.6%	0.39 [0.12, 1.19]
Total (95% CI)		**616**		**750**	**100.0%**	**0.96 [0.51, 1.81]**
Total events	19		26			

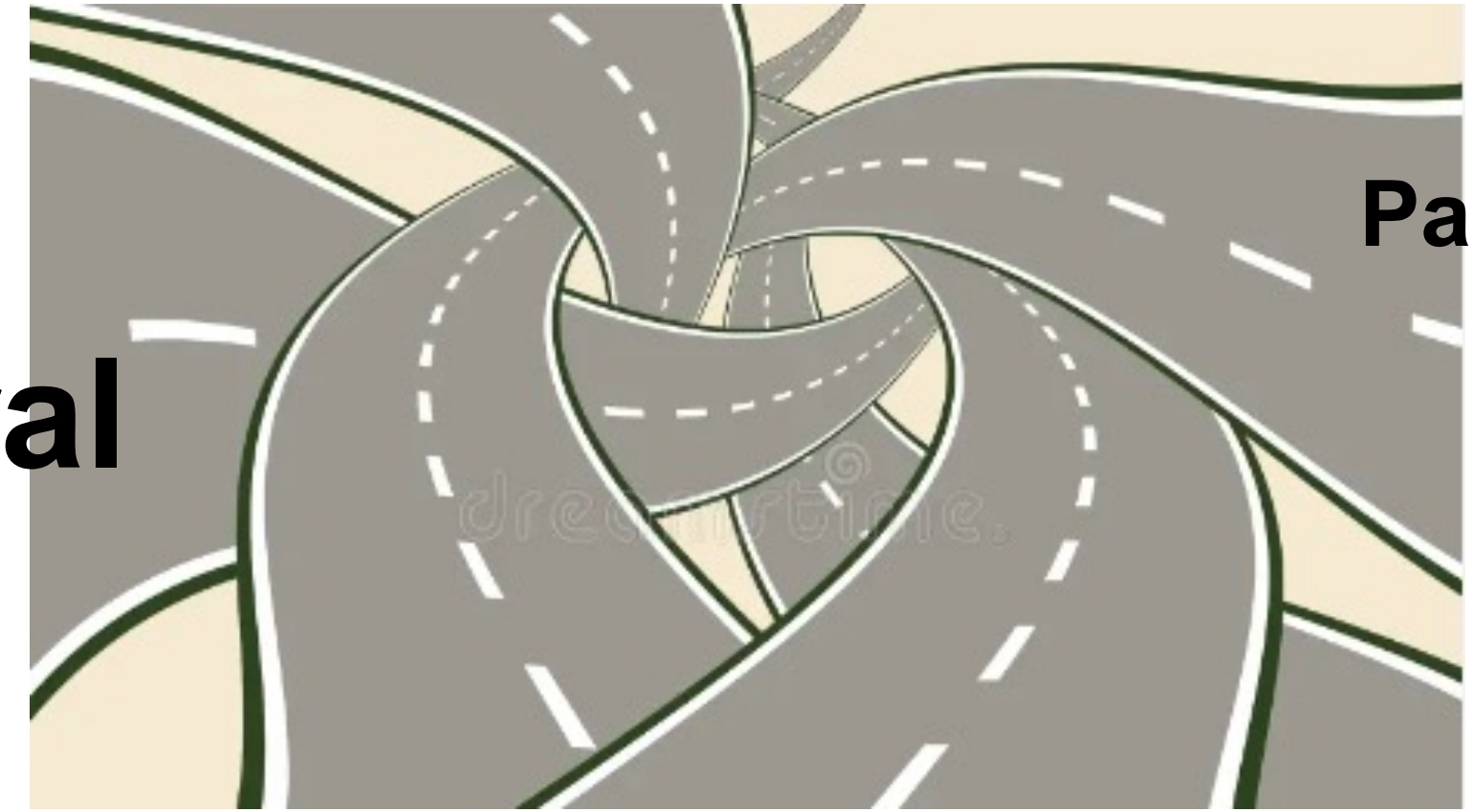
Heterogeneity: Tau² = 0.00; Chi² = 5.87, df = 7 (P = 0.56); I² = 0%
Test for overall effect: Z = 0.13 (P = 0.90)

Odds Ratio M-H, Random, 95% CI

0.01 0.1 1 10 100

Favours [ERAS] Favours [control]

Early postoperative ? Route?



Oral

Parenteral

Combined

Enteral

Subcutaneous

Early postoperative – How?

EARLY FULL FEEDING

From Day 1 by any route (EN-PN)

Total feeding target determined by

- Equation or
- Measured energy expenditure

PROGRESSIVE

Whatever the route (EN-PN)

Whatever the calculated target

ESPEN 1st week ICU: 20 kcal/kg/BW

To start progressive Day1

EN-PN: 10-20 ml/hour by BW

Progression determined by:

EN digestive tolerance / PN blood Glu

Contents lists available at ScienceDirect

Clinical Nutrition

journal homepage: http://www.elsevier.com/locate/clnu

Clinical Nutrition 36 (2017) 623–650

ESPEN guideline: Clinical nutrition in surgery

Arved Weimann [a, *], Marco Braga [b], Franco Carli [c], Takashi Higashiguchi [d], Martin Hübner [e], Stanislaw Klek [f], Alessandro Laviano [g], Olle Ljungqvist [h], Dileep N. Lobo [i], Robert Martindale [j], Dan L. Waitzberg [k], Stephan C. Bischoff [l], Pierre Singer [m]

From a metabolic and nutritional point of view, the key aspects of perioperative care include:

- integration of nutrition into the overall management of the patient
- avoidance of long periods of preoperative fasting
- **re-establishment of oral feeding as early as possible after surgery**
- **start of nutritional therapy early, as soon as a nutritional risk becomes apparent**
- metabolic control e.g. of blood glucose
- reduction of factors which exacerbate stress-related catabolism or impair gastrointestinal function
- minimize time on paralytic agents for ventilator management in the postoperative period
- early mobilisation to facilitate protein synthesis and muscle function.

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Arved Weimann [a, *], Marco Braga [b], Franco Carli [c], Takashi Higashiguchi [d], Martin Hübner [e], Stanislaw Klek [f], Alessandro Laviano [g], Olle Ljungqvist [h], Dileep N. Lobo [i], Robert Martindale [j], Dan L. Waitzberg [k], Stephan C. Bischoff [l], Pierre Singer [m]

Recommendation 3:

In general, oral nutritional intake shall be continued after surgery without interruption (BM, IE).

Grade of recommendation A – strong consensus (90% agreement)

Recommendation 4:

It is recommended to adapt oral intake according to individual tolerance and to the type of surgery carried out with special caution to elderly patients.

Recommendation 5:

Oral intake, including clear liquids, shall be initiated within hours after surgery in most patients.

Grade of recommendation A – strong consensus (100% agreement)

Recommendation 6:

It is recommended to assess the nutritional status before and after major surgery.

Grade of recommendation GPP – strong consensus (100% agreement)

Recommendation 7:

Perioperative nutritional therapy is indicated in patients with malnutrition and those at nutritional risk. Perioperative nutritional therapy should also be initiated, if it is anticipated that the patient will be unable to eat for more than five days perioperatively. It is also indicated in patients expected to have low oral intake and who cannot maintain above 50% of recommended intake for more than seven days. In these situations, it is recommended to initiate nutritional therapy (preferably by the enteral route – ONS-TF) without delay.

Grade of recommendation GPP – strong consensus (92% agreement)

ESPEN guideline: Clinical nutrition in surgery, Weiman et al, Clin Nutr 2017; 36:623-50

Recommendation 8:

If the energy and nutrient requirements cannot be met by oral and enteral intake alone (<50% of caloric requirement) for more than seven days, a combination of enteral and parenteral nutrition is recommended (GPP). Parenteral nutrition shall be administered as soon as possible if nutrition therapy is indicated and there is a contraindication for enteral nutrition, such as in intestinal obstruction (A) (BM).

Grade of recommendation GPP/A – strong consensus (100% agreement)

Comparison of Early Oral Feeding With Traditional Oral Feeding After Total Gastrectomy for Gastric Cancer: A Propensity Score Matching Analysis

Juan Wang et al, Front Oncol . 2019 Nov 7;9:1194

Aim: to compare the feasibility and safety of early oral feeding (EOF) with traditional oral feeding (TOF) after radical total gastrectomy for gastric cancer.

Methods: Retrospective study in consecutive patients who underwent total gastrectomy from April 2016 and Nov. 2018. Two groups, according to their postoperative feeding protocol: EOF group (n = 314) and TOF group (n = 433). The EOF group received oral diet on postoperative D1, while TOF group started on oral feeding after the passage of flatus.

Results: No significant differences in postoperative complications (P = 0.426) and tolerance to oral feeding (P > 0.056) between groups. The changes in perioperative nutritional markers were also similar.

The time to first passage of flatus or defecation (47.2 ± 12.0 h vs. 58.2 ± 9. 9 h, P < 0.0001) and length of postoperative hospital stay (6.4 ± 2.1 days vs. 7.2 ± 2.9days, P < 0.0001) were significantly lower in the EOF group compared to the TOF group.

Conclusion: EOF safe and feasible after radical total gastrectomy with faster recovery and no increased risk of postoperative complications.

Early enteral nutrition in gastrointestinal surgery: a pilot study

J P Velez et al, Nutrition. 1997;13(5):442-5

To test safety of early enteral nutrition (EN) to patients with recent anastomoses.

A prospective pilot trial was carried out to evaluate the tolerance and clinical outcome

P: 46 patients who received early EN following GI surgery.

I: A continuous infusion of an elemental, peptide-based diet into naso-intestinal feeding tube placed beyond the pylorus during surgery. Tube feeds started at **6.2 ±5.0 hrs after surgery** and advanced as tolerated to a rate of 60 mL/h on 3rd postop. day. Patients received the diet either proximal or distal (if gastrectomy) to their recent anastomosis.

R: EN well tolerated with a low incidence of side effects (19.5% mainly nausea and vomiting). Oral feeding was started 2.9 ±1.3 d after surgery. One case of small bowel suture leakage, not related to tube feeding.

C: Early EN appears to be a useful and safe therapeutic alternative for the postoperative management of patients undergoing GI surgery. It may contribute to faster recovery of bowel function and lead to a shorter hospital stay.

Effect of Early vs Late Supplemental Parenteral Nutrition in Patients Undergoing Abdominal Surgery: a RCT

Gao et al, JAMA surgery, 2022;157(5):384-393

P: multicenter RCT in 11 tertiary hospitals in China major abdominal surgery with high nutritional risk and poor tolerance to EN (30% of energy targets from EN on postoperative day 2, calculated as 25 and 30 kcal/kg

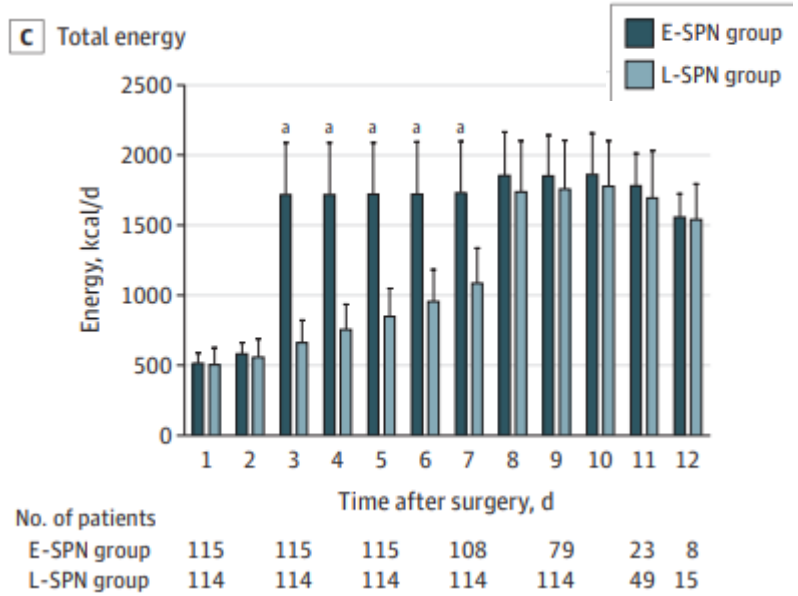
I: early (E-SPN) (**day 3** after surgery)

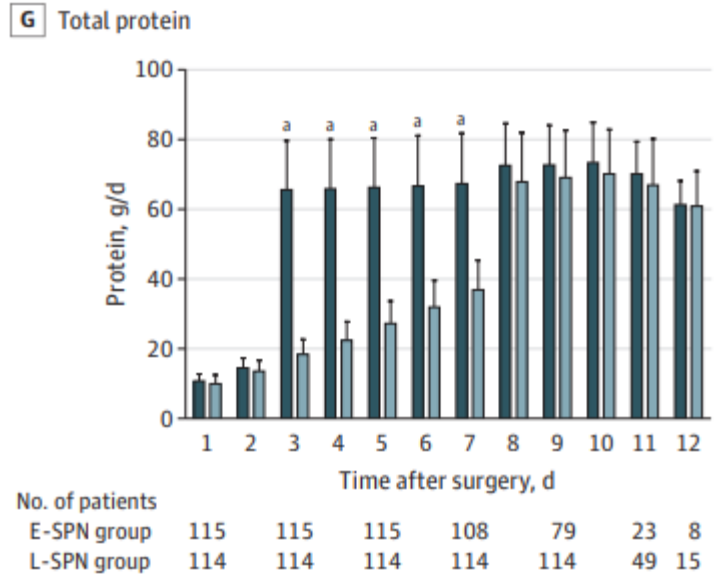
C: late (L-SPN) (**day 8** after surgery)

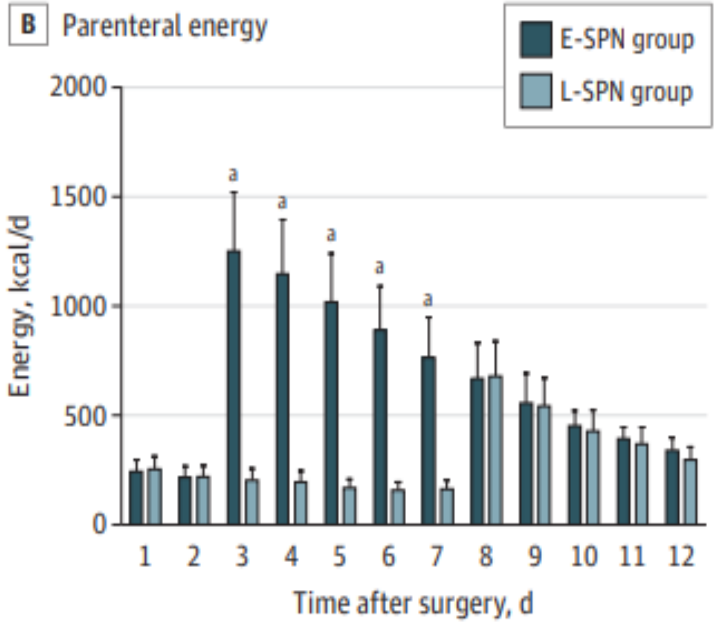
O: incidence of nosocomial infections between postoperative day 3 and hospital discharge

Result: 230 patients (mean [SD] age, 60.1 [11.2] years; 140 men [61.1%]; all patients were of Han race and Asian ethnicity.

E-SPN group had significantly **fewer nosocomial infections** compared with the L-SPN group (10/115 [8.7%] vs 21/114 [18.4%]; risk difference, 9.7%; 95% CI, 0.9%-18.5%; P = 0.04), **therapeutic antibiotic days** between the E-SPN group and the L-SPN group (6.0 [0.8] vs 7.0 [1.1] days; mean difference, 1.0 day; 95% CI, 0.2-1.9 days; P = 0.01)







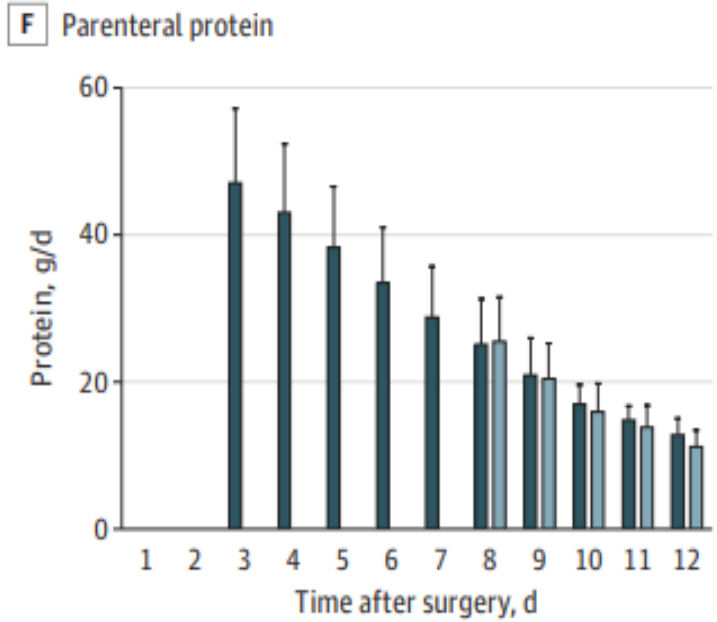
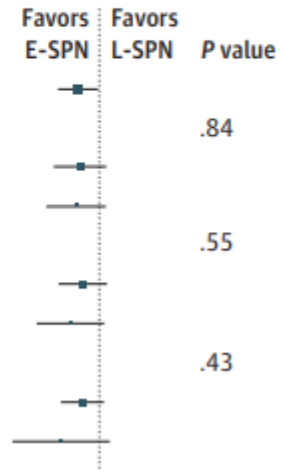


Table 2. Primary and Secondary Clinical Outcomes During the Intervention and Follow-up[a]

Outcome	E-SPN (n = 115)	L-SPN (n = 114)	Absolute difference (95% CI)	*P* value
Primary outcome				
Infectious complications	10 (8.7)	21 (18.4)	9.7 (0.9 to 18.5)	.04
Major infectious				
Pneumonia	5 (4.3)	11 (9.6)	8.8 (0.7 to 17.0)	.04
Abdominal infection	1 (0.9)	4 (3.5)		
Septic shock	0 (0.0)	2 (1.8)		
Bloodstream infection	2 (1.7)	1 (0.9)		

Figure 3. Risk Difference of Early Supplemental Parenteral Nutrition (E-SPN) vs Late Supplemental Parenteral Nutrition (L-SPN) by Prespecified Subgroups

Subgroup	E-SPN infection, No./total No. (%)	L-SPN infection, No./total No. (%)	*P* value
All	10/115 (8.70)	21/114 (18.42)	
Age, y			.84
<65	7/68 (10.29)	14/73 (19.18)	
≥65	3/47 (6.38)	7/41 (17.07)	
Sex			.55
Male	6/71 (8.45)	11/69 (15.94)	
Female	4/44 (9.09)	10/45 (22.22)	
NRS-2002 score			.43
<3	8/92 (8.70)	15/91 (16.48)	
≥3	2/23 (8.70)	6/23 (26.09)	



Gao et al, JAMA surgery, 2022;157(5):384

Early Enteral Nutrition Within 24 h of Intestinal Surgery Versus Later Commencement of Feeding: A Systematic review and Meta-analysis

Lewis SJ et al, J Gastrointestinal Surg 2009; 13: 569–575

Aim: evaluate early commencement of post-operative EN versus traditional management in patients undergoing gastrointestinal surgery.

Methods: included RCTs comparing early feeding (within 24 h) with no feeding in patients undergoing GI surgery. Primary endpoints were infections, anastomotic leakage, mortality, length of hospital stay and complications of feeding.

Results: 13 trials (1,173 patients) included. **Mortality was reduced with early post-operative feeding**. Early post-operative feeding increased vomiting. Suggestion of a reduction of risk of post-surgical complications and reduced length of hospital stay.

Conclusion: There is no obvious advantage in keeping patients 'nil by mouth' following GI surgery. Early EN is associated with reduced mortality, though the mechanism is not clear. This review supports the notion that early commencement of enteral feeding may be of benefit.

Impact of Enhanced Recovery Program after Surgery in Patients Undergoing Pancreatectomy on Postoperative Outcomes: A Controlled before and after Study

Perinel J et al Dig Surg, 2020;37(1):47-55

Implementation of enhanced recovery after surgery (ERAS) program after pancreatic surgery was associated with decreased length of stay (LOS).

Methods: A before/after study with a contemporary control group was undertaken in patients undergoing pancreatectomy. We compared 2 groups: the intervention hospital that implemented ERAS program and the control hospital that performed traditional care; and 2 periods: the preimplementation and the post-implementation period.

Results: About 97 and 75 patients were included in intervention and control hospital. In multivariate analysis, implementation of ERAS was associated with a significantly shorten LOS (hazard ratio 1.61; 95% CI 1.07-2.44) and higher compliance rate (OR 1.34; 95% CI 1.18-1.53).

Conclusion: Implementation of ERAS program was safe and effective after pancreatectomy with high compliance rate. LOS was significantly reduced without compromising morbidity

The effects of early enteral nutrition on mortality after major emergency abdominal surgery: A systematic review and meta-analysis with Trial Sequential Analysis

Burcharth & Falkenberg Clin Nutr 2021; 40(4):1604-1612

From a total of 4741 records screened, a total of 5 RCTs and two non-randomized controlled trials were included covering 1309 patients. The included studies reported no safety issues regarding the use of EEN. A significant reduction in the mortality rate of EEN compared with standard care was seen (OR 0.59 (CI 95% 0.34–1.00), $I^2 = 0\%$).
Meta-analyses on sepsis and postop. pulmonary complications showed non-significant tendencies in favor of EEN compared with standard care.

Conclusion: EEN after major emergency surgery is correlated with reduced mortality, however, more high-quality data regarding the optimal timing and composition of nutrition are needed before final conclusions regarding the effects of EEN can be made.

Enteral feeding, preferably as early as possible

Enteral Nutrition vs Standard Care (NPO or IV dextrose)

Review: EN vs Standard care (less than 5% loss to follow-up)
Comparison: 01 EN and Standard Care
Outcome: 01 All mortality, ITT

Study or sub-category	EN n/N	Standard n/N	OR (fixed) 95% CI	Weight %	OR (fixed) 95% CI	Year
Chuntrasakul et al. 1996	1/21	3/17		13.53	0.23 [0.02, 2.48]	1996
De Ledinghen et al. 1997	3/12	2/10		7.01	1.33 [0.18, 10.12]	1997
Cabre et al. 2000	13/35	19/36		50.46	0.53 [0.20, 1.36]	2000
Pupelis et al. 2001	1/30	7/30		29.00	0.11 [0.01, 0.99]	2001
Page et al. 2002	0/20	0/20			Not estimable	2002
Total (95% CI)	118	113		100.00	0.42 [0.21, 0.87]	

Total events: 18 (EN), 31 (Standard)
Test for heterogeneity: Chi² = 3.11, df = 3 (P = 0.38), I² = 3.4%
Test for overall effect: Z = 2.33 (P = 0.02)

0.1 0.2 0.5 1 2 5 10
Favours EN Favours Standard

Mortality

Doig GS et al, Injury 2011;42(1):50–56.

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EN should be delayed in

- In case of abdominal distension, but not in the absence of bowel sounds
- In cases of ulcer bleeding with a high risk of rebleeding
- In Abdominal Compartment syndrome and in bowel ischemia
- In hemodynamic instability. Special attention in increasing or persisting lactate levels (bowel ischemia).

Early use of the digestive tract - YES

- Several studies and meta-analysis confirm shortening of hospital stay, and even reduction of mortality
- ERAS in several surgical settings has shown that to use the gut early is associated with significant clinical improvement
- The simplest is the best: oral > other, but under monitoring
- Non-ERAS studies are becoming less frequent, showing unanimity in favor of this strategy
- But it feeding must be progressive, and respect eventual contrindications

Thank you !