Congresso Nazionale SINPE 2025

CLINICAL NUTRITION:
shaping a better future
of health care

ERAS e nutrizione artificiale in chirurgia addominale maggiore: quando e perché

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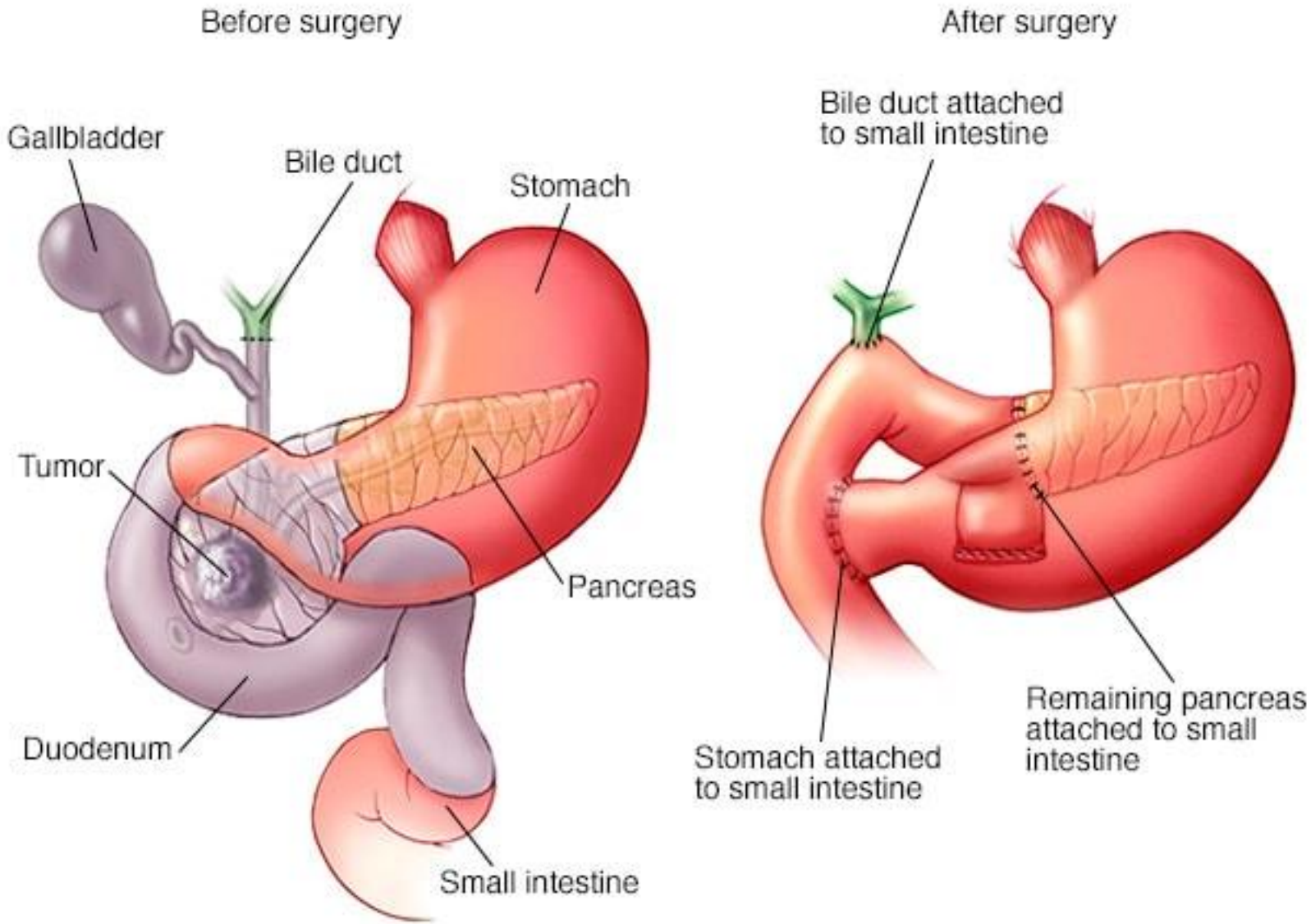
Cos’è la chirurgia addominale maggiore

- Esofagectomie
- Gastrectomie totali
- Duodenocefalopancreasectomie


Before surgery
Gallbladder
Bile duct
Stomach
Tumor
Pancreas
Duodenum
Small intestine
After surgery
Bile duct attached to small intestine
Stomach attached to small intestine
Remaining pancreas attached to small intestine

- Pancreatoduodenectomy (PD) is one of the most complex and challenging abdominal operations with a high rate of morbidity and significant catabolic consequences.
- Delayed gastric emptying (DGE) after PD can compromise the regular resumption of oral food with the risk of developing postoperative malnutrition.
- Moreover, the proportion of patients candidate to PD for cancer may be at high nutritional risk or suffer some nutritional derangements in high proportion of cases at baseline.

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[Intervention Review]

Postoperative nutritional support after pancreaticoduodenectomy in adults

Rachel H Robertson[1], Kylie Russell[2,3], Vanessa Jordan[4], Sanjay Pandanaboyana[5], Dong Wu[6], John Windsor[7]

Editorial group: Cochrane Central Editorial Service.
Publication status and date: New, published in Issue 3, 2025.

OUTCOMES

- Complicanze (maggiori e minori)
- Mortalità
- Degenza
- Fistola pancreatica
- Ritardato svuotamento gastrico
- Emorragia

Early oral feeding
Jejunostomy feeding

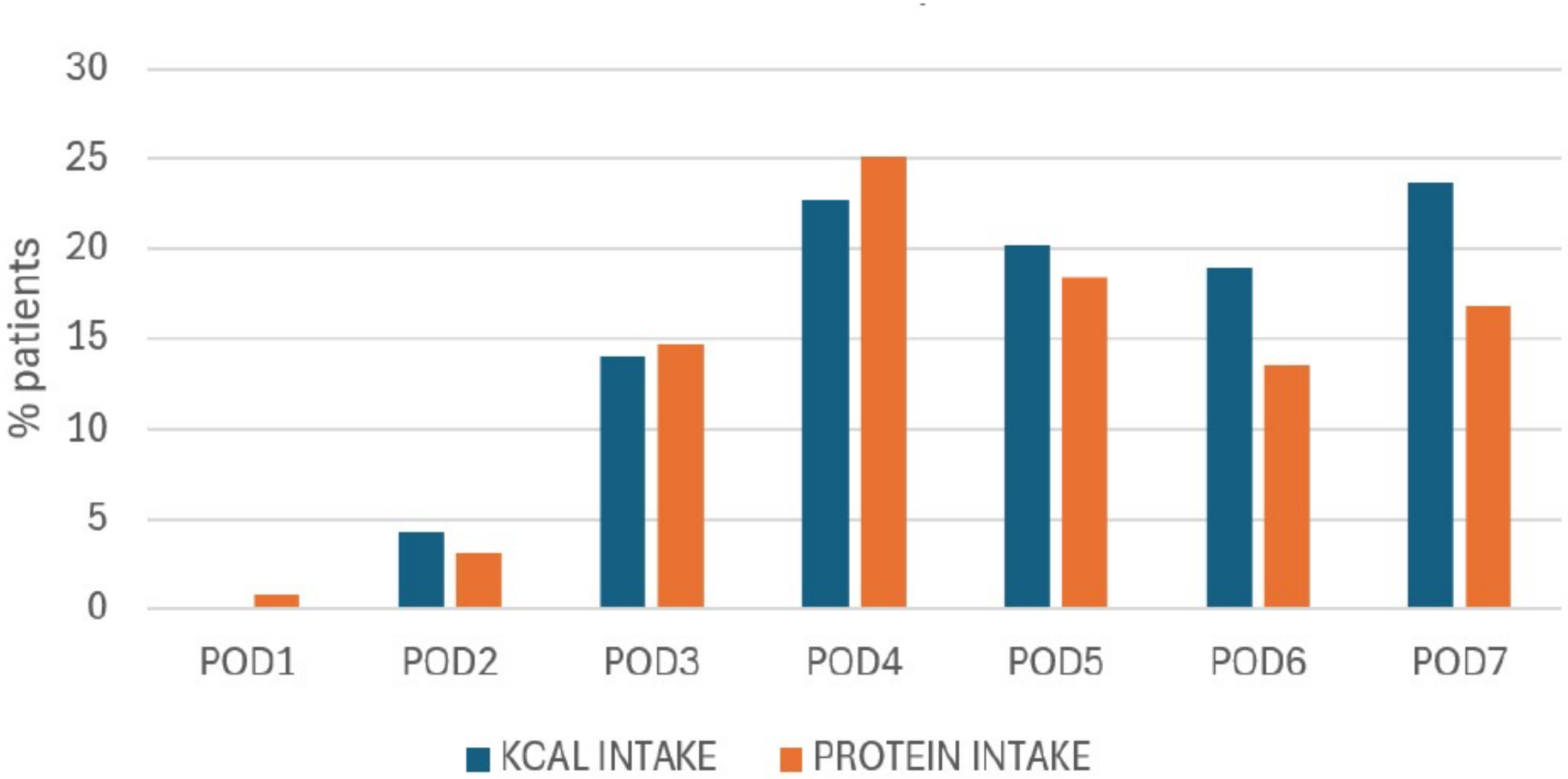
TPN
NJ tube feeding

Implications for research

There were insufficient studies to conduct a meta-analysis that included an early oral intake group. Future randomised controlled trials looking at early oral intake would be helpful to confirm whether this is a safe and beneficial form of postoperative nutrition after pancreaticoduodenectomy.

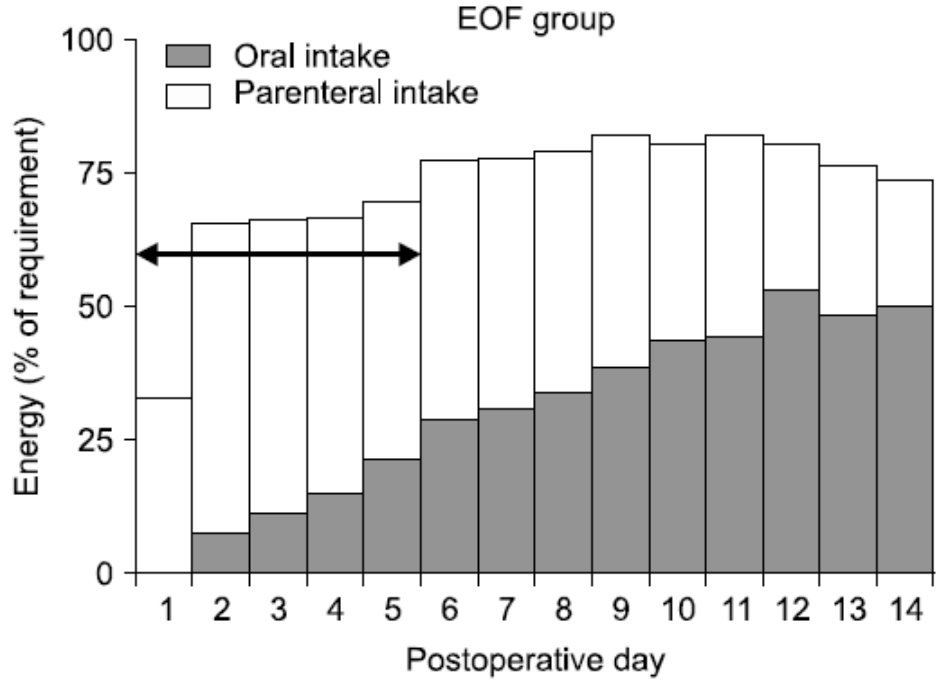
Ideally, in any future study both comparison groups would be part of an Enhanced Recovery After Surgery (ERAS) pathway with the only difference between groups being the type or timing of nutritional support. Use of the Clavien-Dindo classification for postoperative complications would mean that future study reports could more easily be compared and used in a meta-analysis

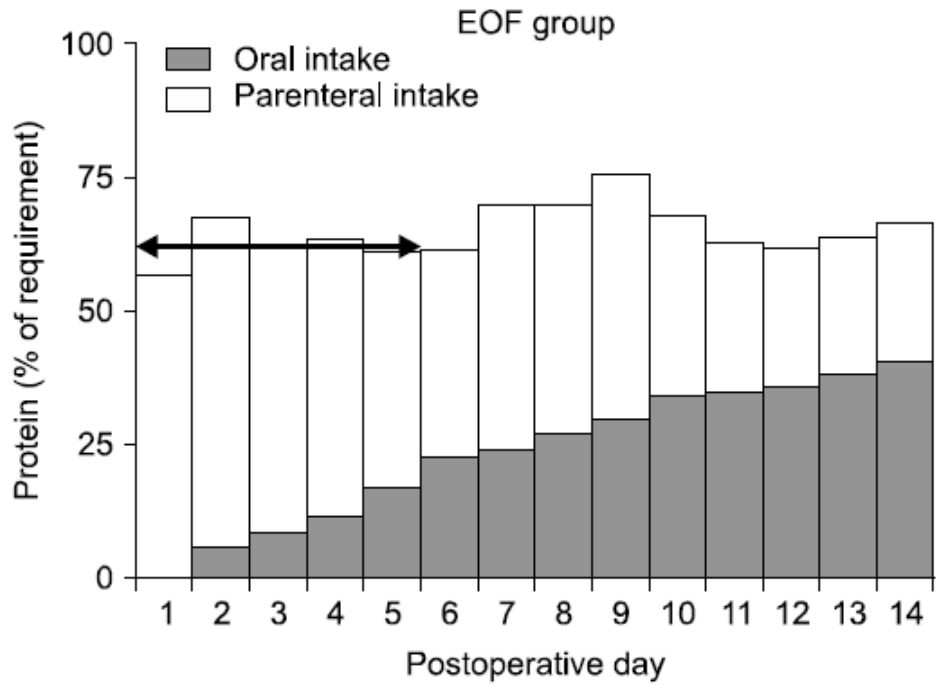
Figure. Ratio of patients who reached 50% of their energetic and protein requirements on postoperative days 1 to 7.



Clinical feasibility and nutritional effects of early oral feeding after pancreaticoduodenectomy

Si Eun Hwang[1], Mi Jin Jung[2], Baik Hwan Cho[3], and Hee Chul Yu[3]





ESPEN guidelines 2025

1. Nutritional therapy should be started immediately after surgery, in patients who are unable to have an oral intake of more than 50% of the recommended amount of energy for more than 7 days.

2. If energy and substrate requirements cannot be met by oral and/or tube feeding alone (<50% of energy requirements) within 3 to 4 days, a combination of oral, enteral, and (supplemental) parenteral nutrition should be given.

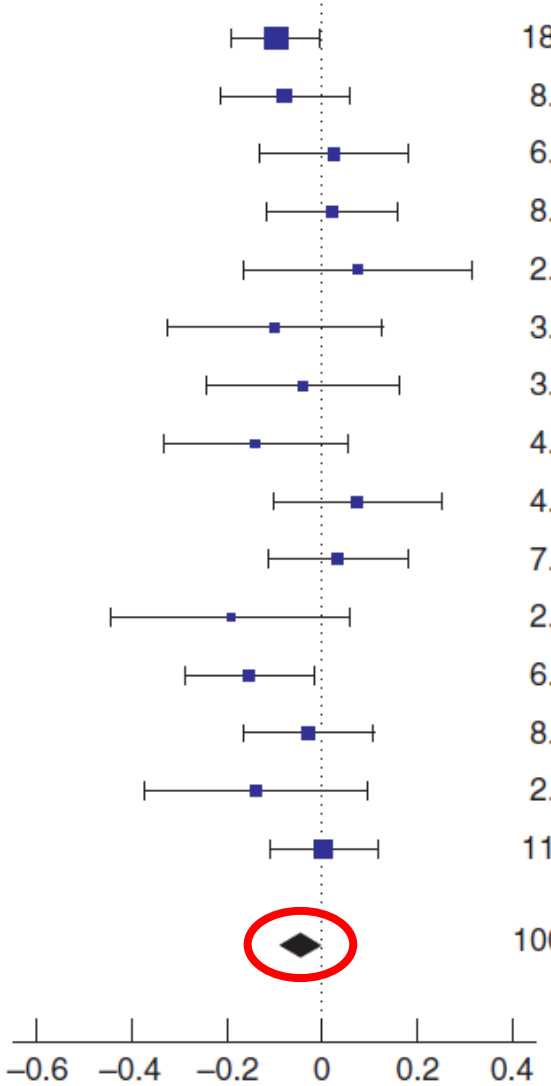
3. Nutritional therapy shall be started within 24 hours in patients in whom the caloric requirements cannot be met orally, or an oral diet is not yet possible.

This applies in particular to:

- Patients after major upper gastrointestinal resection for tumor.
- Patients with malnutrition at the time of surgery.

a Overall complication

Reference	ERAS Positive	ERAS Negative	Conventional Positive	Conventional Negative	Weights (%)	Risk diffrerence
Balzano *et al.*[11]	141	111	165	86	18.10	–0.10 (–0.18, –0.01)
Braga *et al.*[29]	68	47	77	38	8.43	–0.08 (–0.20, –0.05)
Coolsen *et al.*[12]	50	36	54	43	6.32	0.02 (–0.12, 0.17)
Nussbaum *et al.*[43]	43	57	58	84	8.17	0.02 (–0.10, 0.15)
Partelli *et al.*[13]	16	6	43	23	2.72	0.08 (–0.14, 0.29)
Sutcliffe *et al.*[49]	16	18	37	28	3.06	–0.10 (–0.31, 0.11)
Williamson *et al.*[53]	32	18	34	16	3.79	–0.04 (–0.23, 0.15)
Zouros *et al.*[55]	27	48	25	25	4.20	–0.14 (–0.32, 0.04)
Daniel *et al.*[31]	28	35	30	51	4.99	0.07 (–0.09, 0.24)
kagedan *et al.*[34]	88	34	51	23	7.47	0.03 (–0.10, 0.16)
Su *et al.*[48]	18	13	24	7	2.52	–0.19 (–0.42, 0.03)
Van der Kolk *et al.*[51]	11	84	14	38	6.98	–0.15 (–0.29, –0.02)
Hwang *et al.*[33]	64	59	68	56	8.43	–0.03 (–0.15, 0.10)
Lavu *et al.*[39]	11	26	17	22	2.84	–0.14 (–0.35, 0.08)
Lof *et al.*[41]	155	95	77	48	11.97	0.00 (–0.10, 0.11)
FE model for all studies (Q = 15.39, 14d.f., P = 0.352; I^2 = 9.0%)					100.00	–0.04 (–0.08, –0.01)
Overall effect: Z = –2.42, P = 0.015						



3108 individual patient data

Supplemental parenteral nutrition within an enhanced recovery program for open pancreatoduodenectomy for cancer: a pragmatic, multicenter, randomized controlled trial

Luca Gianotti,[a,] Salvatore Paiella,[b,c] Giovanni Capretti,[d,e] Nicolò Pecorelli,[f] Isabella Frigerio,[g] Marta Sandini,[h] Alessandro Fogliati,[a] Eleonora Vico,[a] Marco Braga,[a] Christian Cotsoglou,[i] Alfonso Pedalino,[j] Giuseppe Malleo,[b,c] Simone Ricchitelli,[e] Sabrina Caspani,[d] Giovanni Guarneri,[f] Alessia Vallorani,[f] Alessandro Giardino,[k] Elettra Pasqualoni,[k] Roberto Salvia,[b,l] Alessandro Zerbi,[d,e] Massimo Falconi,[f] Giovanni Butturini,[k] and Davide Paolo Bernasconi[m]*

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2025;87: 103455

Study design

- The RASTA trial has been conducted in five Italian Institutions with proven experience in pancreatic surgery with an established ERAS program.

Patient eligibility

- Adult patients (age ≥ 18 and < 90 years of age) scheduled for elective open pancreatoduodenectomy for any periampullary or pancreatic cancer.

Inclusion criteria

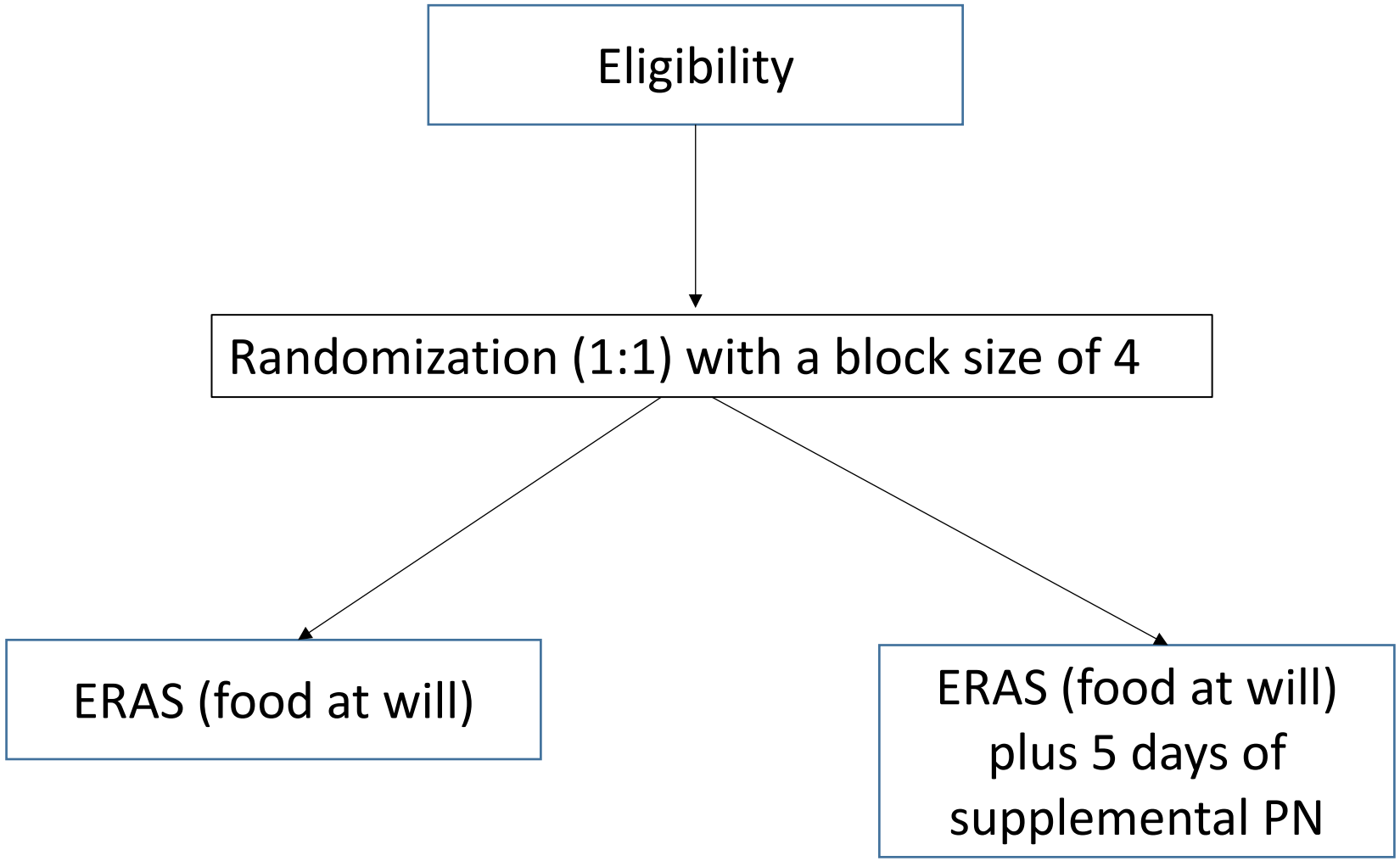
- Patients with written informed consent form.
- Preoperative normal renal function, blood electrolytes and coagulation tests.

Exclusion criteria

- American Society of Anesthesiologists (ASA) physical status classification > 3
- Preoperative severe malnutrition (Weight loss ≥ 15% with respect to usual weight in the last 6 months)
- Palliative surgery
- Early postoperative administration of enteral nutrition *via* a naso-enteric or jejunostomy feeding tube placed during surgery

Rational for the study

To evaluate whether the provision of calories and proteins through supplemental artificial nutrition may improve surgical outcomes after PD in an established ERAS protocol with oral food “at will”



Patients have been randomly allocated to ERAS or ERAS plus PN at 8:00 PM of the day of surgery. Randomization have been performed by a computed-generated permuted-block sequence.

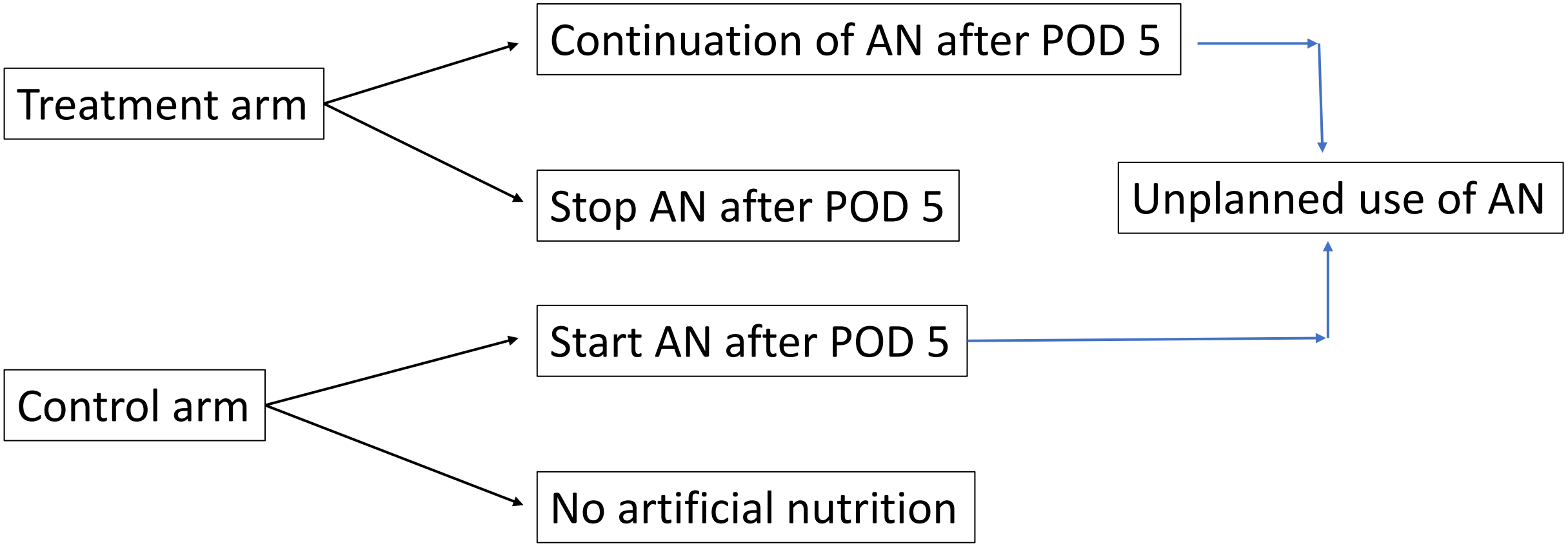
Treatment arm

Patients in the treatment arm have been treated with a full ERAS protocol that establishes oral food “at will” plus supplementary PN from postoperative day (POD) 1 to POD 5. A ready-to-use, all-in-one, 3-bag compartment peripheral parenteral solution containing carbohydrate, lipids and proteins have been infused to deliver $\approx$ 20 total Kcal/kg/day with the addition of I.V. supplementation of vitamins and trace elements.

Control arm

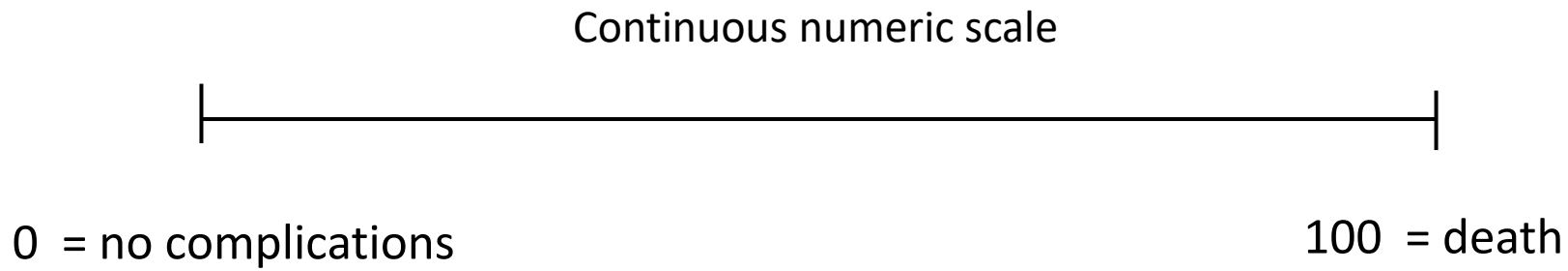
Patients randomized in the control arm have been treated with a full ERAS protocol that establishes oral food “at will” after the operation, but without parenteral nutrition.

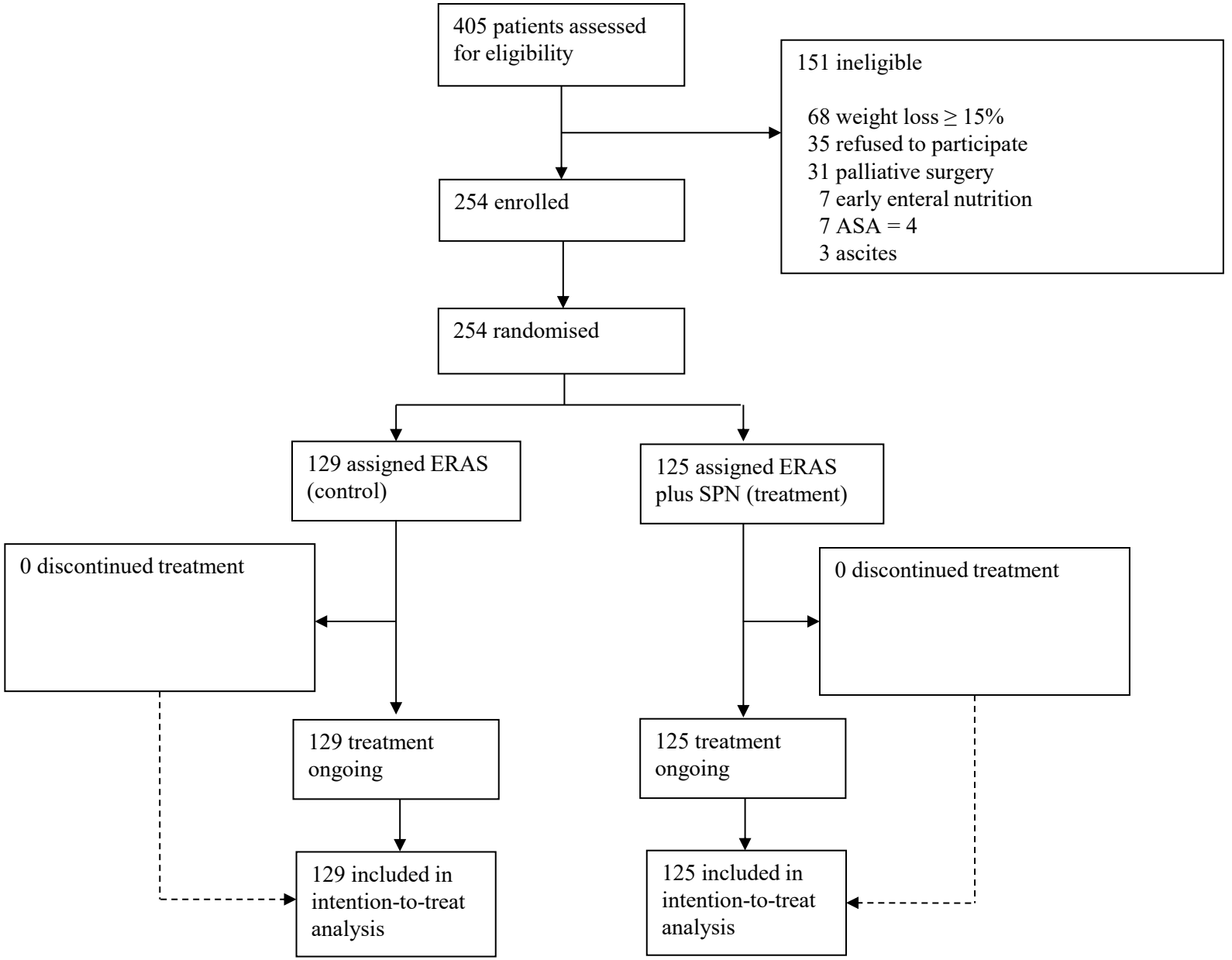
Cross over / unplanned use of AN



Primary endpoint

The primary endpoint of the trial was the complication burden within 90 days after surgery. The complication burden was assessed by the Comprehensive Complication Index (CCI), that incorporates all complications and their severity.




405 patients assessed for eligibility
151 ineligible
68 weight loss ≥ 15%
35 refused to participate
31 palliative surgery
7 early enteral nutrition
7 ASA = 4
3 ascites
254 enrolled
254 randomised
129 assigned ERAS (control)
125 assigned ERAS plus SPN (treatment)
0 discontinued treatment
0 discontinued treatment
129 treatment ongoing
125 treatment ongoing
129 included in intention-to-treat analysis
125 included in intention-to-treat analysis

Variables	Control N = 129	Treatment N = 125
Age, years (mean (SD))	67 (11)	68 (10)
Sex, Female	65 (50.4)	53 (42.4)
Body weight, kg (mean (SD))	68 (13)	69 (13)
Height, cm (mean (SD))	168 (10)	167 (9)
Body mass index, kg/m^2 (mean (SD))	24.3 (3.4)	24.5 (4.1)
Nutritional risk score-2002		
0	42 (32.8)	50 (40)
1	31 (24.2)	22 (17.6)
2	20 (15.6)	20 (16.0)
3	22 (17.2)	18 (14.4)
4	8 (6.2)	8 (6.4)
5	3 (2.3)	4 (3.2)
6	2 (1.6)	3 (2.4)
Nutritional risk score-2002 $\geq$ 3	35 (27.3)	33 (26.4)
% body weight loss	0 [0, 7]	0 [0, 6.3]
Any body weight loss	57 (44.2)	51 (40.8)
Charlson comorbidity index	5 [3, 6]	5 [4, 6]
Smoker		
Former	19 (14.7)	25 (20)
Active	29 (22.5)	30 (24)
Diabetes	30 (23.2)	22 (17.6)
Cardiac disease		
Ischemic	14 (10.9)	10 (8)
Other	8 (5.4)	10 (7.2)
Hypertension	76 (58.9)	57 (45.6)
Pulmonary disease		
COPD	8 (6.2)	4 (3.2)
Other	4 (3.1)	6 (4.8)
ASA classification		
1	18 (14)	20 (16)
2	62 (48.1)	66 (52.8)
3	49 (38)	39 (31.2)

Primary endpoint

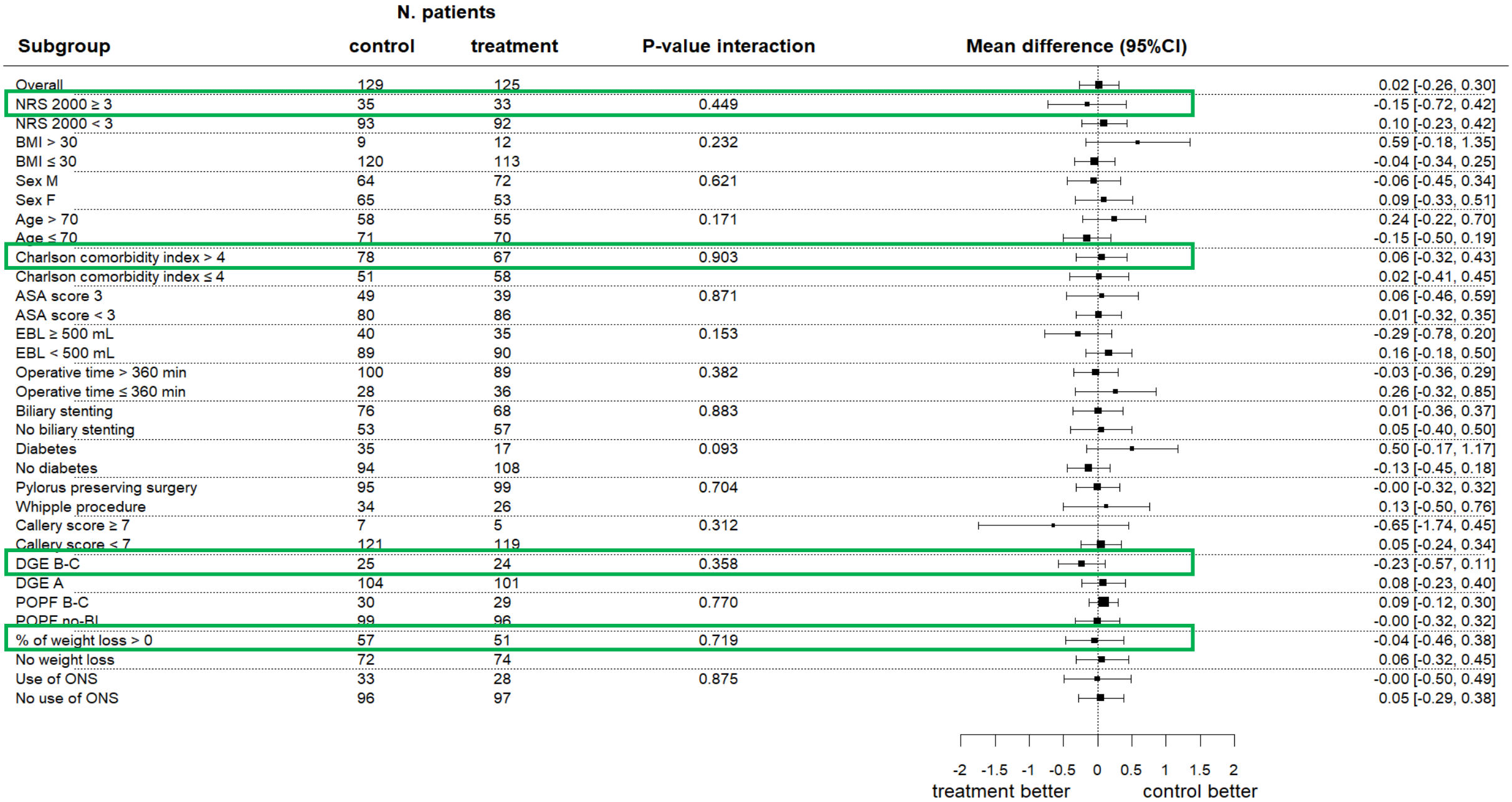
Variables	Control N = 129	Treatment N = 125	Median difference (95% CI) or Mean difference (95% CI) or Geometric mean ratio (95% CI) or Risk difference (95% CI)	P
CCI	20.9 [0, 37.2]	20.9 [0, 37.2]	0[a] (−1.7; 1.7)	0.83
Log CCI	2.72 (1.12)	2.74 (1.15)	0.02[b] (−0.27; 0.3)	0.89
			0.98[c] (0.74; 1.30)	
CCI in patients with CCI >0	29.6 [20.9, 43.5]	29.2 [20.9, 42.5]	0.4[a] (−11.1; 7)	0.99
CCI >20.9	56 (43.4)	59 (47.2)	3.8[d] (−9.2; 16.8)	0.63

CCI, Comprehensive complication index. Values are medians [interquartile range] or numbers (%). [a]Median difference. [b]Mean difference. [c]Geometric mean difference. [d]Risk difference.

Table 2: Primary outcome.

Variables	Control N = 129	Treatment N = 125	Risk difference (95% CI) or Median difference (95% CI)	P-value
Daily calories per kilogram	NA	21.3 [17.8, 24.2]	NA	NA
Unplanned artificial nutrition	83 (64.3)	62 (49.6)	14.7 (1.9; 27.6)	0.025
Prealbumin POD 1, mg/dL	13 [10.5, 14.5]	13 [11, 17]	0 (−2; 0)	0.13
Prealbumin POD 6, mg/dL	11 [8, 14]	13 [9, 16]	2 (−1; 3.5)	0.0026
Delta Prealbumin baseline-POD1, mg/dL	−3 [−7, −1]	−5 [−8, −1.2]	−2 (−5; 0)	0.201
Delta Prealbumin baseline-POD6, mg/dL	−4 [−9, −2]	−4 [−8.5, 0]	0 (−3; 3)	0.56
Delta Prealbumin POD1-POD6, mg/dL	−1 [−3, 1]	1 [−4, 3]	2 (−1; 3)	0.041
Blood glucose level POD1, mg/dL	151 [122, 176]	150 [130, 184]	−1 (−15; 12)	0.22
Blood glucose level POD2, mg/dL	124 [99, 144]	142 [122, 169]	18 (8.5; 27)	<0.0001
Blood glucose level POD3, mg/dL	116 [95, 140]	137 [120, 171]	21 (11; 29.5)	<0.0001
Blood glucose level POD4, mg/dL	113 [100, 135]	133 [117, 162]	20 (9; 29.5)	<0.0001
Blood glucose level POD5, mg/dL	117 [101, 152]	132 [115, 155]	15 (5; 23)	0.005
Resumption of bowel function, day				
Gas	2 [2, 3]	2 [2, 3]	0 (−1; 1)	0.40
Stools	4 [3, 5]	4 [3, 5]	0 (−1; 1)	0.93
90-d morbidity	87 (67.4)	79 (63.2)	−4.2 (−16.7; 8.2)	0.56
Pancreatic fistula				
BL	13 (10.1)	14 (11.2)	1.1 (−7.3; 9.5)	0.54
B	29 (22.5)	25 (20)	−2.5 (−13.3; 8.4)	
C	1 (0.8)	4 (3.2)	2.4 (−1.8; 6.6)	
Biliary fistula				
A	7 (5.4)	9 (7.2)	1.8 (−5.0; 8.5)	0.47
B	1 (0.8)	3 (2.4)	1.6 (−2.2; 5.5)	
C	0 (0)	1 (0.8)	0.8 (−1.5; 3.1)	
Enteric fistula	3 (2.3)	2 (1.6)	−0.7 (−4.9; 3.4)	1

Delayed gastric empting				
A	16 (12.4)	16 (12.8)	0.4 (−8.2; 9)	0.98
B	9 (7.0)	8 (6.4)	−0.6 (−7.3; 6.1)	
Surgical site infection				
Incisional	21 (16.3)	13 (10.4)	−5.9 (−15; 3.2)	0.39
Organ/space	26 (20.2)	27 (21.6)	1.4 (−9.3; 12.2)	
Infection with MDR bacteria	37 (28.7)	31 (24.8)	−3.9 (−15.5; 7.8)	0.58
Cardiac complication	9 (7.0)	9 (7.2)	0.2 (−6.3; 6.8)	1
Pulmonary complication	11 (8.5)	8 (6.4)	−2.1 (−9.4; 5.1)	0.89
Urinary tract infection	7 (5.4)	6 (4.8)	−0.6 (−6.7; 5.4)	1
Acute kidney injury	10 (7.8)	7 (5.6)	−2.2 (−9.1; 4.8)	0.66
Relaparotomy	7 (5.4)	10 (8.0)	2.6 (−4.4; 9.5)	0.57
Unplanned ICU admission	13 (10.1)	16 (12.8)	2.7 (−5.9; 11.3)	0.63
Severity of complication (Clavien-Dindo score)				
1	13 (10.1)	14 (11.2)	1.1 (−7.3; 9.5)	0.99
2	49 (38.0)	46 (36.8)	−1.2 (−13.9; 11.5)	
3A	15 (11.6)	17 (13.6)	2 (−7; 10.9)	
3B	5 (3.9)	4 (3.2)	−0.7 (−5.9; 4.5)	
4A	3 (2.3)	3 (2.4)	0.1 (−3.7; 3.9)	
4B	2 (1.6)	3 (2.4)	0.8 (−3.4; 5.1)	
90-d mortality	2 (1.6)	4 (3.2)	1.6 (−2.9; 6.2)	0.65
Delta body weight, kg	−3 [5, 0]	−3 [−5, 0]	0 (−2; 0.5)	0.64
Length of stay, day	12 [9, 19]	12 [8, 20]	0 (−5; 1)	0.95
Functional recovery, day	11 [8, 18]	12 [7, 18]	1 (−2; 3)	0.94
90-d unplanned hospital readmission	12 (8.3)	12 (9.3)	1 (−4.6; 10.1)	0.72


N. patients
Subgroup
control
treatment
P-value interaction
Mean difference (95%CI)
Overall 129 125 0.02 [-0.26, 0.30]
NRS 2000 ≥ 3 35 33 0.449 -0.15 [-0.72, 0.42]
NRS 2000 < 3 93 92 0.10 [-0.23, 0.42]
BMI > 30 9 12 0.232 0.59 [-0.18, 1.35]
BMI ≤ 30 120 113 -0.04 [-0.34, 0.25]
Sex M 64 72 0.621 -0.06 [-0.45, 0.34]
Sex F 65 53 0.09 [-0.33, 0.51]
Age > 70 58 55 0.171 0.24 [-0.22, 0.70]
Age ≤ 70 71 70 -0.15 [-0.50, 0.19]
Charlson comorbidity index > 4 78 67 0.903 0.06 [-0.32, 0.43]
Charlson comorbidity index ≤ 4 51 58 0.02 [-0.41, 0.45]
ASA score 3 49 39 0.871 0.06 [-0.46, 0.59]
ASA score < 3 80 86 0.01 [-0.32, 0.35]
EBL ≥ 500 mL 40 35 0.153 -0.29 [-0.78, 0.20]
EBL < 500 mL 89 90 0.16 [-0.18, 0.50]
Operative time > 360 min 100 89 0.382 -0.03 [-0.36, 0.29]
Operative time ≤ 360 min 28 36 0.26 [-0.32, 0.85]
Biliary stenting 76 68 0.883 0.01 [-0.36, 0.37]
No biliary stenting 53 57 0.05 [-0.40, 0.50]
Diabetes 35 17 0.093 0.50 [-0.17, 1.17]
No diabetes 94 108 -0.13 [-0.45, 0.18]
Pylorus preserving surgery 95 99 0.704 -0.00 [-0.32, 0.32]
Whipple procedure 34 26 0.13 [-0.50, 0.76]
Callery score ≥ 7 7 5 0.312 -0.65 [-1.74, 0.45]
Callery score < 7 121 119 0.05 [-0.24, 0.34]
DGE B-C 25 24 0.358 -0.23 [-0.57, 0.11]
DGE A 104 101 0.08 [-0.23, 0.40]
POPF B-C 30 29 0.770 0.09 [-0.12, 0.30]
POPF no-BL 99 96 -0.00 [-0.32, 0.32]
% of weight loss > 0 57 51 0.719 -0.04 [-0.46, 0.38]
No weight loss 72 74 0.06 [-0.32, 0.45]
Use of ONS 33 28 0.875 -0.00 [-0.50, 0.49]
No use of ONS 96 97 0.05 [-0.29, 0.38]
-2 -1.5 -1 -0.5 0 0.5 1 1.5 2
treatment better
control better

Subgroup	Control N=129	Treatment N=125	Risk Difference (95%CI) or Mean Difference (95%CI) or Median Difference (95%CI)
Unplanned artificial nutrition No	83 (64.3) CCI: 8.7 [0;20.9] Log CCI: 2.24 (1.08) CCI>20.9: 20/83 (24.1)	62 (49.6) CCI: 8.7 [0;20.9] Log CCI: 2.16 (1.08) CCI>20.9: 13/62 (21.0)	0 (-16.6; 12.2) -0.8 (-5.99; 5.59) -3.1 (-18.2; 12.0)
Unplanned artificial nutrition Yes	46 (35.7) CCI: 40.9 [24.3;52.1] Log CCI: 3.60 (0.68) CCI> 20.9: 36/46 (78.3) Duration of artificial nutrition: 11 days [6;18]	63 (50.4) CCI: 35.7 [20.9;47.0] Log CCI: 3.32 (0.92) CCI > 20.9: 46/63 (73.0) Duration of artificial nutrition: 9 days [6;18]	-5.2 (-13.7; 3.3) -0.28 (-15.76; 2.21) -5.3 (-23.3; 12.8) -2 (-6.5; 2)

Conclusions

- According to current literature, early oral feeding appears not inferior to early enteral feeding on morbidity after pancreatoduodenectomy.
- The results of the RASTA trial suggest that additional calories and proteins delivered through supplemental PN do not add significant benefits on surgical outcomes when a full ERAS program is implemented.
- Supplemental PN has no significant effects also in patients with high nutritional risk or with weight loss < 15%.

ESPEN guidelines 2025

1. Nutritional therapy should be started immediately after surgery, in patients who are unable to have an oral intake of more than 50% of the recommended amount of energy for more than 7 days.

2. If energy and substrate requirements cannot be met by oral and/or tube feeding alone (<50% of energy requirements) within 3 to 4 days, a combination of oral, enteral, and (supplemental) parenteral nutrition should be given.

3. Nutritional therapy shall be started within 24 hours in patients in whom the caloric requirements cannot be met orally, or an oral diet is not yet possible.

This applies in particular to:

- Patients after major upper gastrointestinal resection for tumor.
- Patients with malnutrition at the time of surgery.

Background

ERAS protocol is a bundle of interventions derived from the best evidence-based perioperative treatments aimed to accelerate patient functional recovery through the reduction of dysmetabolism and dyshomeostasis caused by surgery- and anesthesiology-related injury.

The enhanced recovery after surgery (ERAS®) program should be now considered the gold-standard pathway for perioperative care in many types of major surgical operations including pancreatic resections for the better patient outcomes and reduced healthcare-related costs when compared to traditional care.