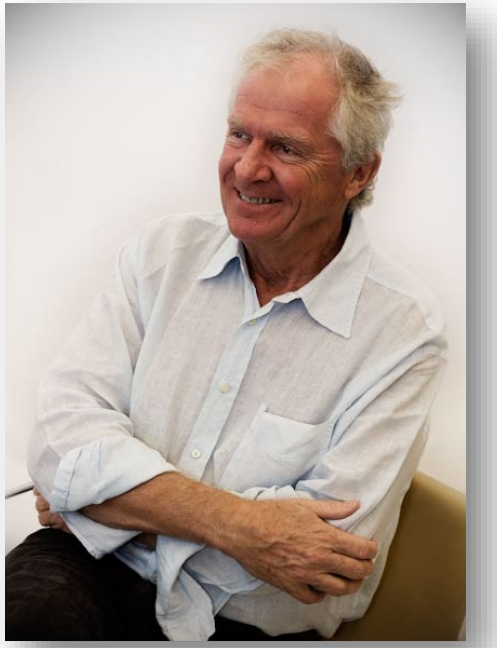
胰腺外科ERAS与营养支持疗法

北京协和医院 临床营养科 陈伟

加速康复外科理念

ERAS = Enhanced Recovery After Surgery

- ✓ 以循证医学证据为基础
- ✓ 以减少手术患者的生理及心理的创伤应激为目的
- ✓ 通过外科、麻醉、护理、营养等多学科协作
- ✓ 对围手术期处理的临床路径予以优化
- ✓ 实现患者加速康复



British Journal of Anaesthesia 1997; 78: 606–617

Multimodal approach to control postoperative pathophysiology and rehabilitation

H. KEHLET

Dr. Henrik Kehlet 于1997年提出ERAS概念,被誉为“加速康复外科之父”

Kehlet H .[J]. British Journal of Anaesthesia, 1997.

ERAS的工作基础—多学科团队

- 由**多学科团队**（Multidisciplinary Team, MDT)共同完成
  - ✓ 外科医师、麻醉医师、护师
  - ✓ 家庭支持、营养师、护工等共同努力
- 病人积极配合（生理及心理）

  Coordination from patients (physically & mentally)
- 家属理解与支持

  Understanding & Support from families

Ljungqvist O, et al. JAMA Surg 2017. 52(3):292-8.

国外多中心ERAS项目成功经验——美国KPNC (Kaiser Permanente Northern California)

The Kaiser Permanente Northern California Enhanced Recovery After Surgery Program: Design, Development, and Implementation

Vincent X Liu, MD, MS; Efren Rosas, MD; Judith C Hwang, MD, MBA; Eric Cain, MD, MBA; Anne Foss-Durant, RN, MSN, FNP, MBA; Molly Clopp, RN, MS, MBA; Mengfei Huang, MSc; Alexander Mustille; Vivian M Reyes, MD; Shirley S Paulson DNP(c), MPA, RN, NEA-BC; Michelle Caughey, MD; Stephen Parodi, MD

Perm J 2017;21:17-003

20家医院

15849位病人

术后并发症降低1/3

住院患者死亡率降低

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Original Investigation | ONLINE ONLY

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More

Enhanced Recovery After Surgery Program Implementation in 2 Surgical Populations in an Integrated Health Care Delivery System

Vincent X. Liu, MD, MS[1,2]; Efren Rosas, MD[2]; Judith Hwang, MD, MBA[2]; et al

» Author Affiliations

JAMA Surg. 2017;152(7):e171032. doi:10.1001/jamasurg.2017.1032

Key Points

Question What is the influence of implementation of an enhanced recovery after surgery program on outcomes among patients undergoing elective colorectal resection and emergency hip fracture repair?

Findings In this pre-post difference-in-differences study of 15 849 surgical patients at 20 medical centers in Northern California, implementation of a multifaceted enhanced recovery program was associated with a one-third reduction in postoperative complication rates in the target population relative to comparator surgical populations. The program was also associated with decreased hospital mortality among patients undergoing colorectal resection and increased rates of discharge to home among patients undergoing hip fracture repair.

Meaning Large-scale implementation of an enhanced recovery after surgery program significantly improved many processes and outcomes of surgical care in 2 distinct populations.

国外多中心ERAS项目成功经验——美国KPNC

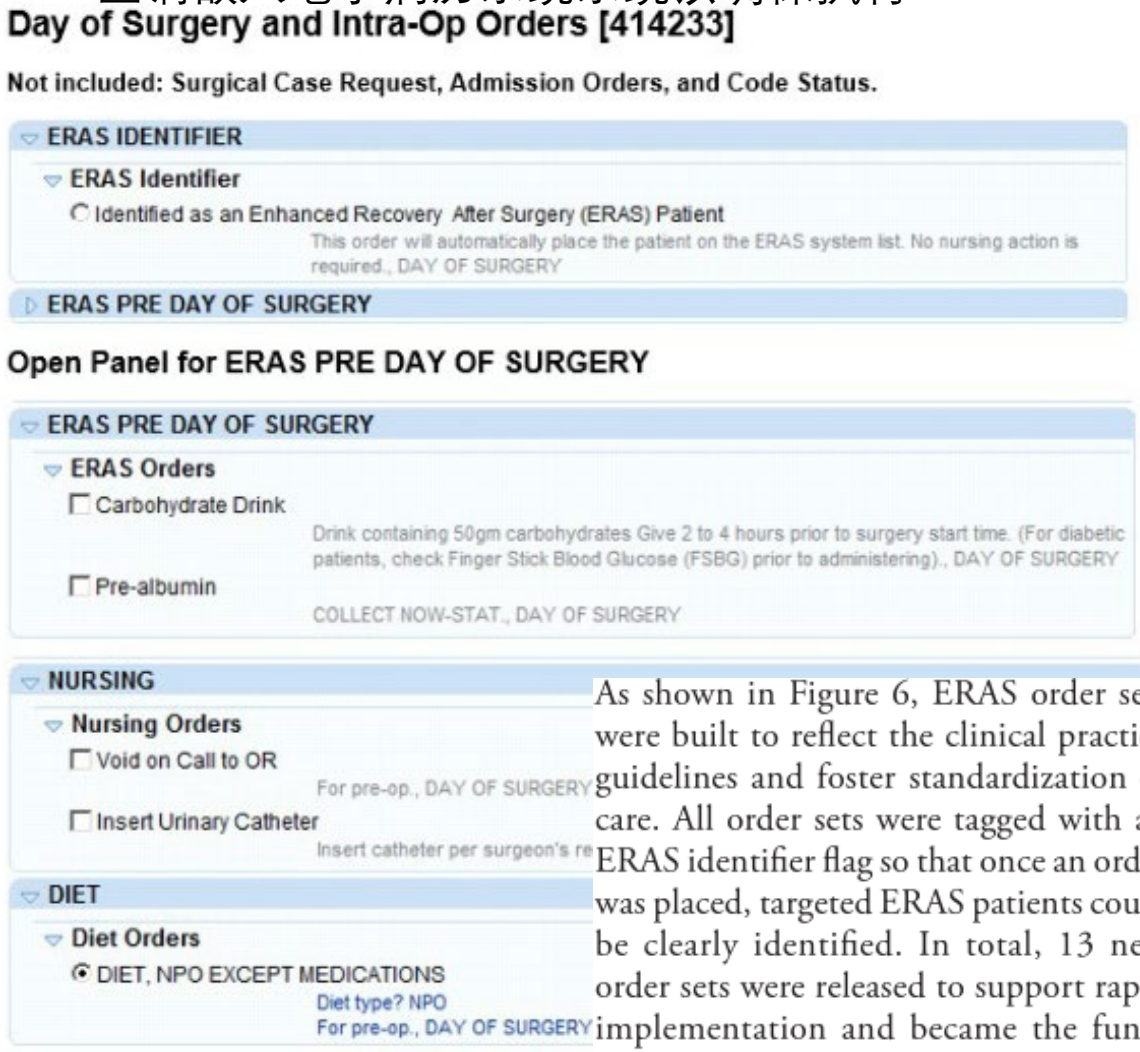
ERAS临床路径

Table 1. Sample of an enhanced recovery preoperative clinical pathway

Item No.	Practice	Team member
1	**Standard preoperative clinical pathway item**	
1.1	**Patient education** to help inform of ERAS approaches that may be unfamiliar (eg, reducing narcotics, early feeding and ambulation)	Surgery MA/RN and Preoperative Medicine MA/RN
1.2	**No prolonged fasting** Clear liquids up to 2 hours before surgery (including carbohydrate loading with drink). Acceptable substitutes: juice or drink. Do not use in patients with bowel obstruction or on nasogastric tube. See amended guidance for diabetics. Solids up to 8 hours before surgery	RN in clinic and Preoperative Medicine
1.3	**Chlorhexidine mouthwash** (HAP measure)	Surgeon/RN
1.4	**Chlorhexidine wipe** (SSI bundle)	Surgeon/RN
1.5	**Standardizing PONV prophylaxis**	Anesthesia/RN
2	**Colorectal patients only**	
2.1	**Preoperative albumin for risk assessment**	Surgeon Preoperative Medicine/laboratory
3	**Multimodal pain management**	
3.1	**Decrease sedative medications,** especially in the elderly population (eg, midazolam, 2 mg maximum)	Anesthesia/RN
3.2	**Acetaminophen** (caution in patients with liver disease) Patient weight ≥ 50 kg, 1 g IV single dose Patient weight < 50 kg, 15 mg/kg IV single dose	Surgeon/RN/ Anesthesia
3.3	**Gabapentin** (if already on this medicine, continue usual dose) Patients aged 18-59 years: 600 mg oral single dose Patients aged 60-69 years: 300 mg oral single dose	Surgeon/NR

ERAS = Enhanced Recovery After Surgery; HAP = hospital-acquired pneumonia; IV = intravenous; MA = medical assistant; PONV = postoperative nausea and vomiting; RN = registered nurse; SSI = surgical site infection.

ERAS医嘱嵌入电子病历系统系统以确保执行



As shown in Figure 6, ERAS order sets were built to reflect the clinical practice guidelines and foster standardization of care. All order sets were tagged with an ERAS identifier flag so that once an order was placed, targeted ERAS patients could be clearly identified. In total, 13 new order sets were released to support rapid implementation and became the functional backbone supporting rapid practice change. As new surgery types were added to the ERAS project, more order sets were developed in rapid cycle fashion.

ERAS能给手术患者带来什么?

江志伟，黎介寿等，

80例接受胃癌根治切除术患者，平均年龄55.8岁，ERAS组与传统对照组的术后观察对比

术后两组观察指标变化情况

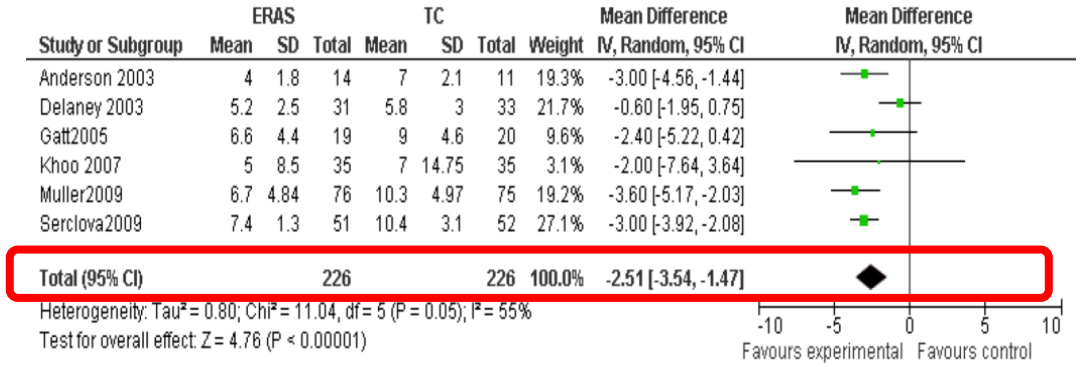
项目	ERAS组	传统对照组
术后住院天数（d）	5.6±1.3	9.4±1.9[a]
首次排期时间（d）	3.3±0.4	4.5±0.9[a]
停止静脉输液时间（d）	4.5±1.4	6.8±1.9[a]
体重下降（kg）	3.2±0.8	4.3±1.6[a]
治疗费用	18620±2360	20370±2440[a]
注：与ERAS组相比，[a]P<0.05		

术后并发症观察

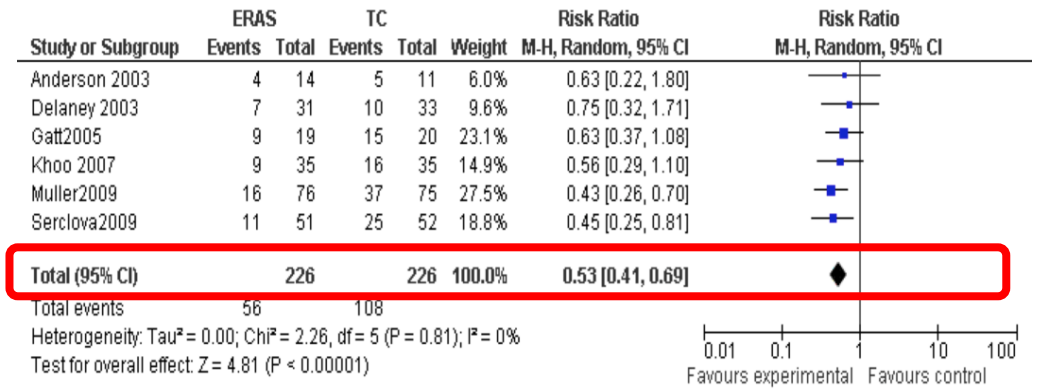
项目	ERAS组	传统对照组
死亡率（%）	0	0
并发症（%）	10.0%	17.5%
吻合口瘘	无	无
腹腔感染	无	无

中华外科杂志（2007） 45（19） 1314-1317

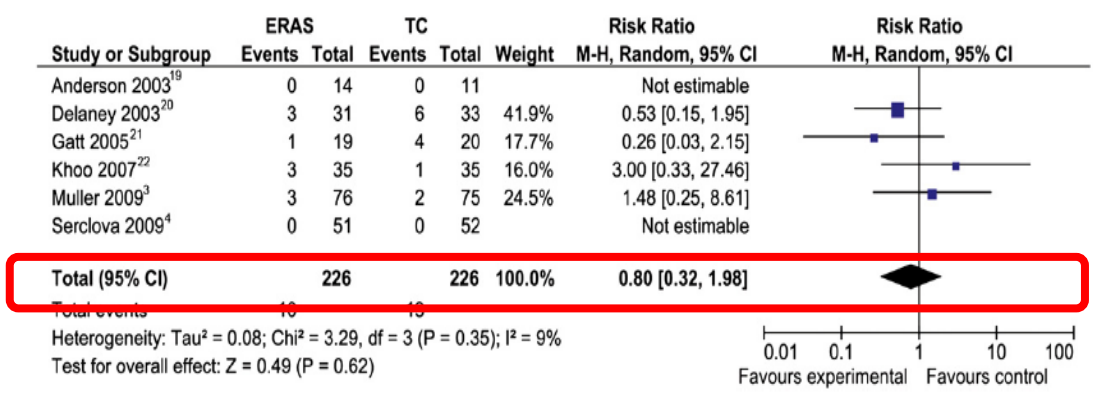
ERAS改善患者临床结局



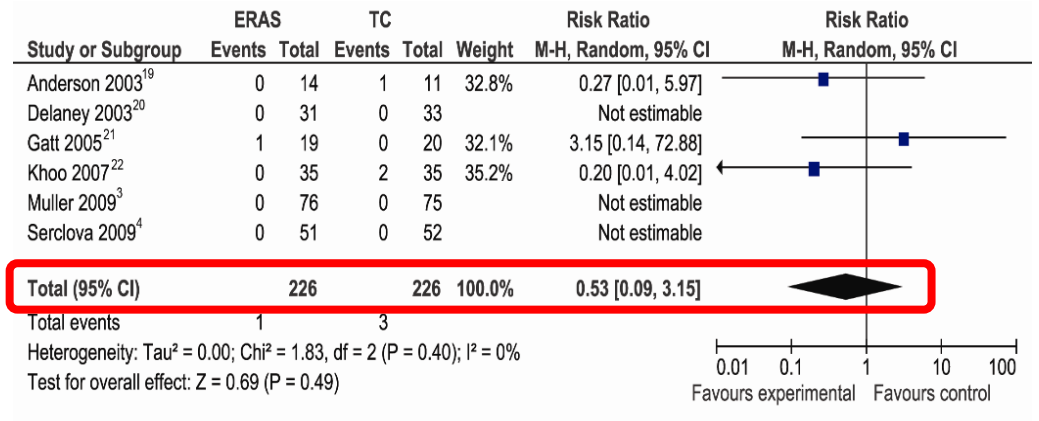
ERAS 可缩短住院时间2.5天



ERAS 可降低并发症发生率 47%



ERAS 可降低患者再入院风险 20%



ERAS可降低患者死亡风险 47%

Varadhan K K, et al. Clinical Nutrition, 2010

ERAS在多科手术中应用

Operation	Hospital stay
Laparoscopic cholecystectomy	Ambulatory procedure[3]
Laparoscopic or vaginal hysterectomy	Ambulatory procedure, 1 day[4]
Laparoscopic gastro-oesophageal reflux surgery	Ambulatory procedure, 1 day[5]
Elective surgery for aortic aneurysm	3-4 days[6]
Carotid endarterectomy	1-2 days[7]
Mastectomy	Ambulatory procedure, 1 day[8]
Lung lobectomy	1-2 days[9]
Prostatectomy	1-2 days[10]
Partial colectomy	2 days[11]

ERAS使多科手术患者的住院时间缩短

Gustafsson U O, et al. Archives of Surgery, 2011.

Clinical Nutrition 31 (2012) 783–800

Contents lists available at SciVerse ScienceDirect

Clinical Nutrition

Review

Consensus

中国实用外科杂志 2015年8月 第35 卷 第8期

指南与共识

Enhanced Rec

natur 中华消化外科杂志 2015 年 1 月第 14 卷第 1 期 Chin J Dig Surg, January 2015, Vol. 14, No. 1

· 指南解读 ·

CME

2014 年欧洲加速康复外科协会《胃切除术加速康复外科指南》热点问题解读

张树 江志伟 黎介寿

Stephen A. McClave, MD[1], John K. DiBaise, MD, FACG[2], Gerard E. Mullin, MD, FACG[3] and Robert G. Martindale, MD, PhD[4]

Clinical Nutrition 31 (2012) 817–830

Contents lists available at SciVerse ScienceDirect

Clinical Nutrition

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

Lassen K, Coolsen MM, Slim K, et al. Guidelines for perioperative care for pancreaticoduodenectomy: Enhanced Recovery After Surgery

Clin Nutr. 2012 Dec;31(6):817-30.

胰腺外科的营养困惑？**ERAS**真的能够实施吗？

Pancreatic cancer surgery and nutrition management: a review of the current literature

Table 1 Screening tools

Screen	Clinical parameters	Score/results
SGA	Questionnaire: weight loss, changes in dietary intake, gastrointestinal symptoms, functional capacity Physical examination: muscle, subcutaneous fat, sacral and ankle edema, ascites Clinician's overall judgment	Stage A, well-nourished; stage B, moderate or suspected malnutrition; stage C, severe malnutrition
PG-SGA	Weight loss Condition and age Metabolic stress Physical examination	Stage A, well-nourished; stage B, moderate or suspected malnutrition; stage C, severe malnutrition
aPG-SGA	Weight and weight change Food intake Symptoms Activities and functions	Score 0-1, no nutrition problem; score 2-8, increasing nutrition problem; score ≥9, critical need for improved symptom management and/or nutrition intervention
MUST	BMI Weight loss Presence of acute disease	0, low risk; 1, medium risk; 2, high risk
NRI	Serum albumin level Ratio of actual to usual weight	>100.0, no risk; 97.5-100.0, low risk; 83.5-97.5, medium risk; ≤83.5, high risk
NRS-2002	Age adjustment (≥70 years) Nutritional score: weight loss, changes in food intake, BMI, general condition Severity of disease score	Pt rescreened if score <3 (absent, mild, or moderate risk); nutrition care plan initiated if score ≥3 (severe risk)

SGA, subjective global assessment; PG-SGA, patient-generated subjective assessment; aPG-SGA, abridged patient-generated subjective assessment; MUST, malnutrition universal screening tool; NRI, nutritional risk index; NRS, nutritional risk screening; BMI, body mass index.

Table 2 Glasgow prognostic score (23)

Biochemical measurements	Score
CRP ≤10 mg/L and albumin ≥3.5 g/dL	0
CRP ≤10 mg/L and albumin <3.5 g/dL	0
CRP >10 mg/L	1
CRP >10 mg/L and albumin <3.5 g/dL	2

CRP, C-reactive protein.

Table 3 Feeding modality

Enteral access	Pros	Cons
Nasojejunal tube	Non-invasive enteral strategy Early enteral feeding	Dislodgement Occlusion Discomfort
Gastrojejunal tube	Ability to vent and feed via single tube Improved patient comfort	Dislodgement Occlusion Malfunction of gastric port
Jejunal tube	Early enteral feeding	Bowel strangulation Volvulus Leakage
Parenteral nutrition	Ability to feed in the setting of ileus or mechanical obstruction	Increased costs Infectious complications

胰腺外科ERAS工作中营养的角色?

ERAS工作中的营养视角

肠外与肠内营养 2015 年 3 月 第 22 卷 第 2 期 Parenteral & Enteral Nutrition, Vol. 22, No. 2, March, 2015 · 65 ·

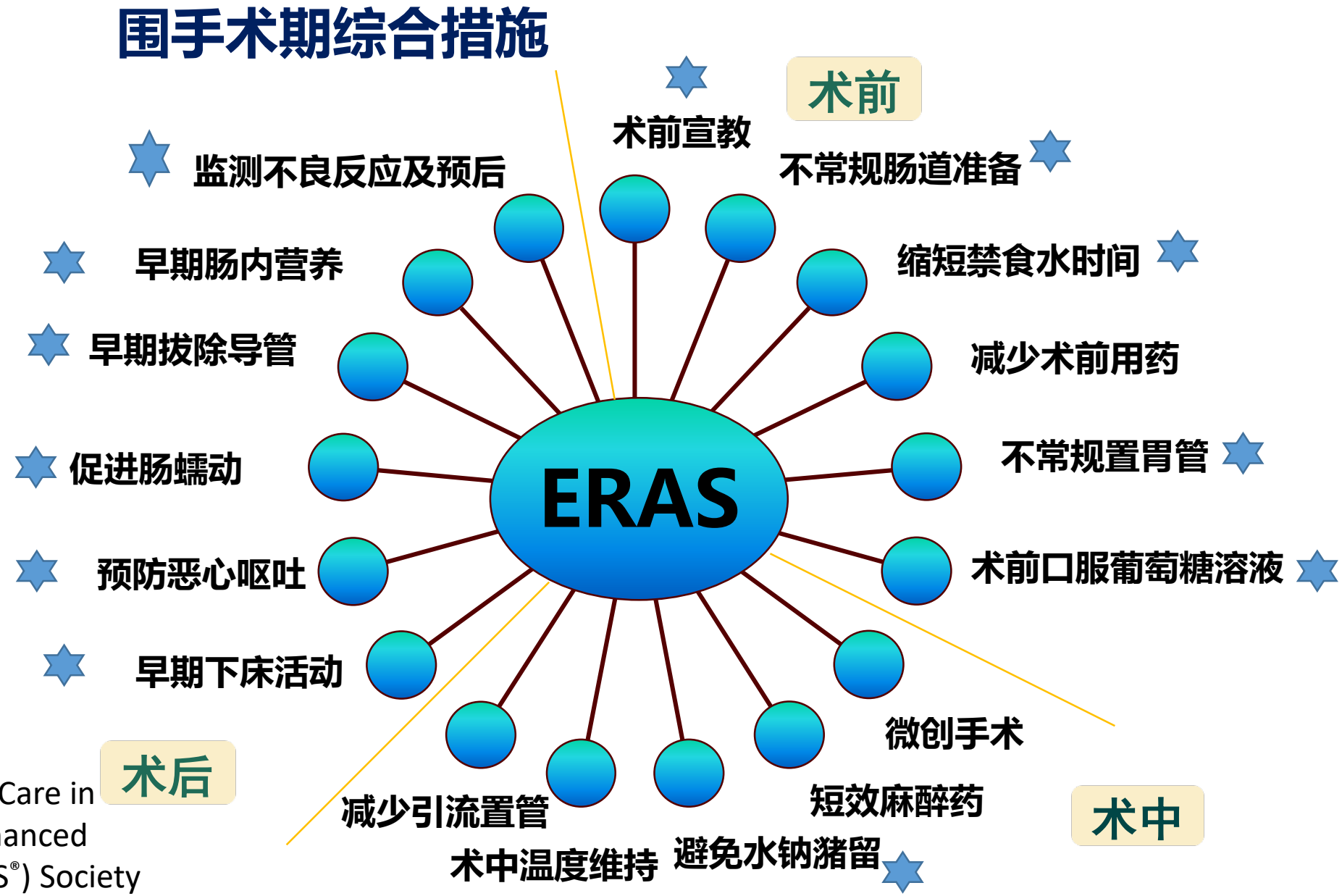
· 院士论坛 ·

营养支持治疗与加速康复外科

黎介寿
（南京军区南京总医院 解放军普通外科研究所，江苏南京 210002）

时 间	营养处理
手术前	若无营养不良，无需增加营养处理
手术当天	
前夜	①午夜起禁食；②至手术日早晨，白饮 12.5% 葡萄糖液 800 ml
术前 2～3 h	饮 12.5% 葡萄糖液 400 ml
术中	①控制输液量和糖；②术者根据手术与病人术后的处理（化疗、较长时间 EN）考虑施行空肠置管造口
手术后	
6 h	开始进饮料（不含牛奶），无需等待肠蠕动
第 1 天	流质饮食或 EN（1/4～1/3 需要量）
第 3～5 天	根据病人的耐受情况，每天增加 1/4～1/3 量，直至全需要量
第 6 天	若病人仍不能口服全量饮食，或 EN 供给量不足，可给予 PN

ERAS措施



Guidelines for Perioperative Care in Elective Colonic Surgery: Enhanced Recovery After Surgery (ERAS®) Society Recommendations（2013版）

Fearon KC, et al. Clin Nutr 2005.

ERAS的营养全视角管理

	胃	结直肠	出发点
术前评估及宣教	通过NRS2002评估病人的营养风险情况		
术前营养	营养不良的患者需要进行营养治疗，推荐术前口服补充营养或行肠内营养支持治疗		术前营养不良将增加术后并发症，延缓胃肠功能恢复，延长住院日
术前肠道准备	不提倡对病人常规肠道准备		1、术前常规肠道准备对病人是一个应激刺激，可能导致脱水及电解质失衡；2、Mate 分析结果表明，肠道准备对结肠手术病人无益处,还有可能增加术后发生肠吻合口瘘的危险。
术前禁食禁饮和补充碳水化合物	1、无胃肠道动力障碍者麻醉6h前允许进食（包括EN），2h前允许进食清流质；2、术前6~12h饮800mL的12.5%葡萄糖液，术前2~3h饮400 mL		可以减少术前的口渴、饥饿及烦躁，并且显著降低术后胰岛素抵抗发生率，降低了术后高血糖及并发症的发生率。
放置鼻胃管	不应常规放置鼻胃管减压		降低术后发热、肺不张及肺炎的发生率。
术后恶心、呕吐的治疗	术后早期活动，应用甲氧氯普胺药物以及术后第 1 ～ 2 天拔除鼻胃管	避免使用可能引起呕吐的药物如新斯的明、阿片类药物等，有呕吐风险的病人应预防性使用止吐药如昂丹斯琼、地塞米松等。	有助于早期进食
预防肠麻痹以及促进胃肠蠕动	避免或减少使用阿片类镇痛药、避免过量液体输入、早期恢复口服进食等。术后口服硫酸镁、比沙可啶或乳果糖等可促进胃肠运动功能恢复。		
术后营养治疗	第1天开始进食进水（包括EN），如在术后第6天起没有达到目标量60%的患者给予个体化的营养支持	口服营养在手术前以及术后4h就开始。	1、能对肠黏膜起滋养作用，也促进肠蠕动，门静脉循，这是PN不具有的作用；2、早期肠内营养时，可以促进氮平衡,而减少了术后高血糖的发生

术前宣教：宣教哪些内容？有何作用？

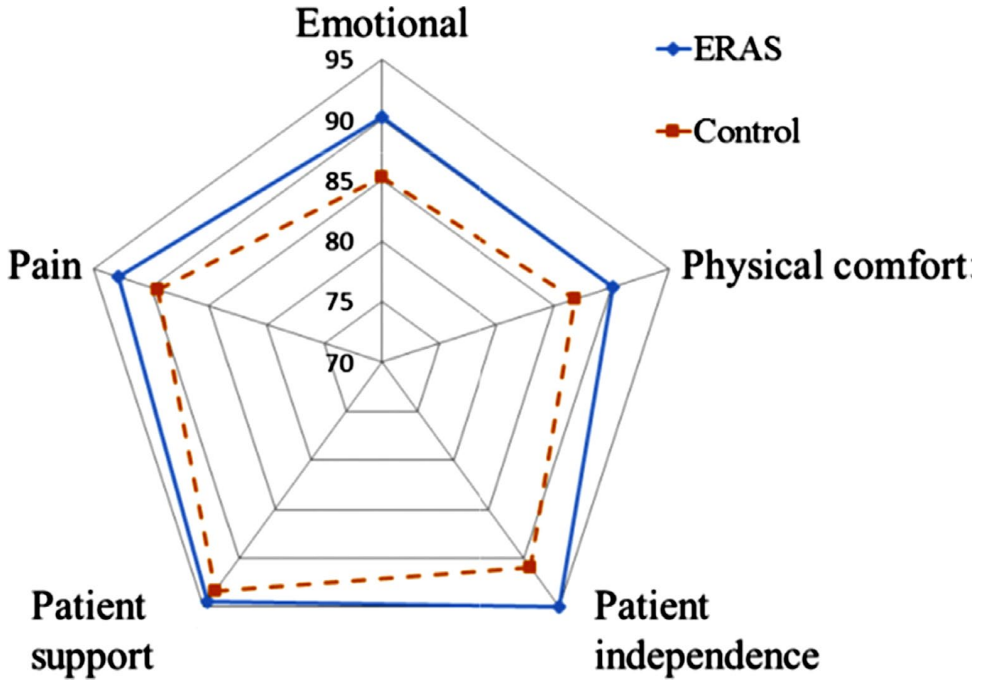
- 多形式重点介绍麻醉、手术、术后处理等围手术期诊疗过程，缓解其焦虑、恐惧及紧张情绪，获得病人及其家属的理解、配合

ERAS在胰十二指肠切除术病人应用（RCT）：

- ERAS组：37例
- 对照组: 37例
- Japanese version of the QoR-40 (QoR-40J)

评估患者生活质量结果对比：

ERAS组患者情绪及独立能力均明显优于对照组



Kosei Takagi et al, Clinical Nutrition. 2018

术前营养筛查

- **营养不良是与不良结局明确相关**
  - 回顾性分析2013-2015年间490 例行腹部大手术患者
  - 营养不良诊断标准：ASPEN/AND criteria（2015）
  - 19.3%的患者有中重度营养不良
  - 营养不良会延长住院时间（LOS），增加医疗费用、院内病死率和严重并发症发生率并使再入院率升高

Factor	Moderately/ severely malnourished ($n = 93$), % (n)	Well-nourished ($n = 397$), % (n)	P value
Postoperative LOS			
Median	8 (1-98)	6 (1-52)	<0.0001
Total cost			
Median	$32,502 ($6482-$454,433)	$21,163 (6052-$135,993)	<0.0001
In-hospital mortality	7.5 (7)	2.3 (9)	0.021
Readmissions	22.6 (22)	16.1 (63)	0.045

Mosquera C, et al. Journal of Surgical Research. 2016

营养不良临床诊断标准

第一步. 应用经过验证的工具诊断营养风险, e.g. NRS 2002, MUST, MNA(-SF), …

i.e. BMI, 体重下降, 饮食减少, 疾病严重程度

第二步. 诊断

BMI <18.5 kg/m²

或

体重下降>10% (不论时间)/**>5%** 过去3个月

合并以下任一点

BMI <20 (if <70 years)/**<22** (if >70 y)

或

- **FFMI <15**（女） and **17**（男） kg/m²

Cederholm *et al.* Clin Nutr 2015

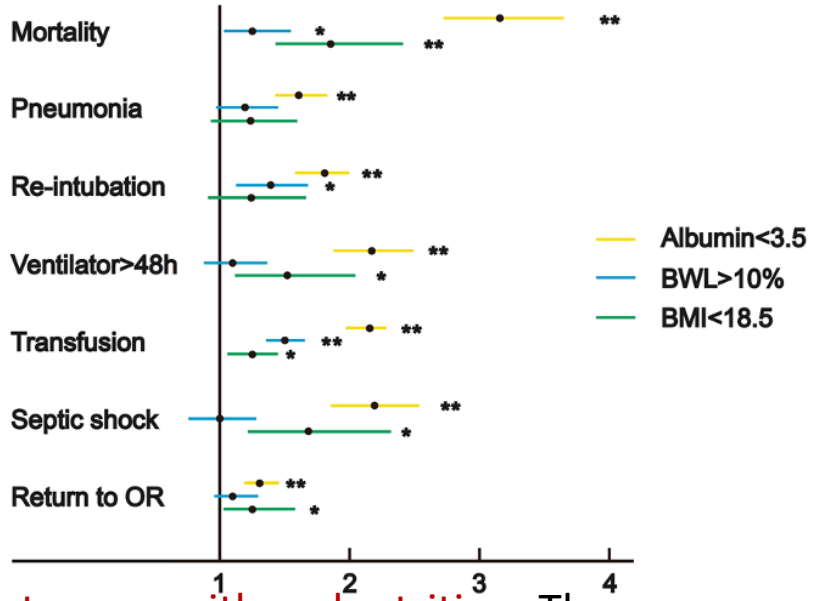
术前营养筛查

- **营养状态是预测术后病死率的重要因素**
  - **回顾性分析42,483 例结直肠癌手术患者**
  - **营养判定指标：Albumin＜3.5g/dl，Body weight loss(BWL)＞10%, BMI＜18.5kg/m2**
  - **与术后病死率显著相关的因素：**

    Hypoalbuminemia (HR= 3.064, p < 0.001)

    BWL＞10%, (HR = 1.229, p = 0.033)

    BMI <18.5 kg/m2(HR = 1.797, p < 0.001)



Hu et al. Nutrition Journal (2015)

Adjusted odds ratio plot of the association between significant postoperative outcomes with malnutrition. They were evaluated by serum albumin, BWL and BMI, respectively. *p < 0.05, **p < 0.001, multivariate logistic regression.

营养筛查与评定方法

- 入院即筛查：**营养风险评分2002（nutritional risk screening 2002, NRS2002）**
- 当合并下述任一情况时应视为存在**严重营养风险**：
  - 6 个月内体重下降＞10%；
  - 主观全面评定(SGA) C级或 NRS 2002 评分＞5 分；
  - BMI＜18.5 kg/m^2；
  - 血清白蛋白＜30 g/L

Weimann A, et al. Clin Nutr, 2017
赵玉沛，中国实用外科杂志，2018

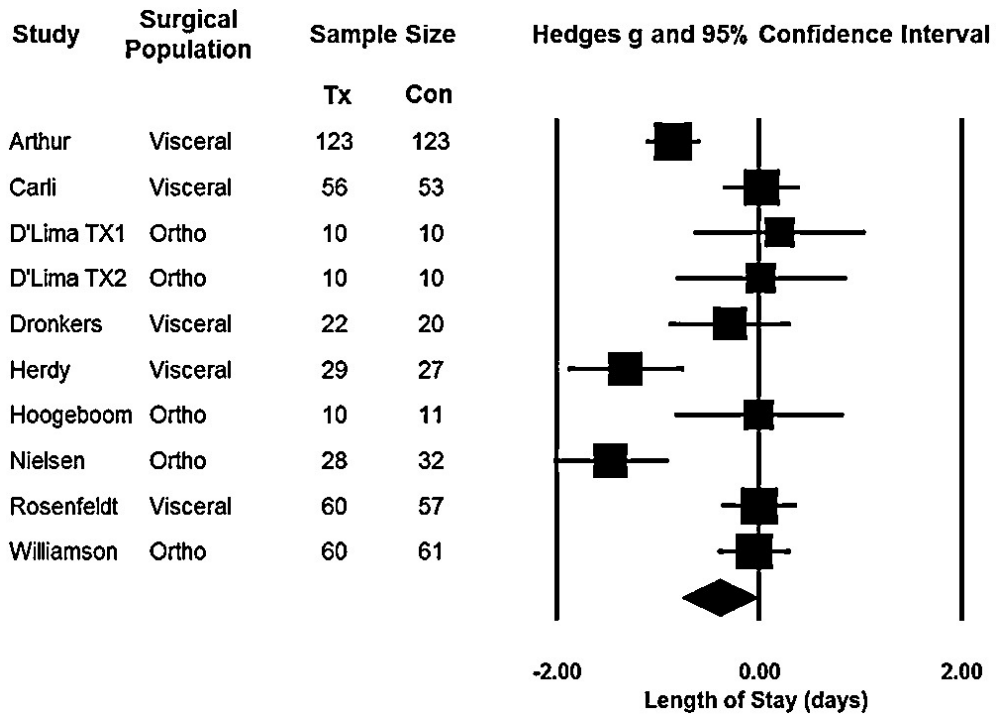
术前“预康复”

- 预康复（prehabilitation）是指让患者采取一些多模式的术前康复措施以提高机体功能储备，降低术后并发症，减少术后住院康复时间，从而缩短住院时间和减少费用。
- 多模式预康复：
  1. 戒烟、限酒
  2. 纠正营养不良
  3. 血糖调整
  4. 个体化体育锻炼
  5. 心理适应

Kehlet H, et al. Am J Surg,2002

预康复加快术后恢复

- 系统综述与meta分析：1995-2011年，最终纳入21个临床研究
- 研究一致认为：
  - 术前预康复可减轻术后疼痛
  - 促进患者体力状态
  - 改善健康相关生活质量
- meta分析：
  - 缩短术后住院时间
    (Hedges' g = −0.39, P = 0.033)



Santa Mina D, et al. Physiotherapy 2014.

预康复降低术后并发症

- 评估个体化的预康复对高风险择期腹部大手术患者手术并发症的影响
- RCT: 对照组-标准治疗；干预组：标准治疗+预康复（2~6w）
- 预康复措施：① 动机访谈；② 高强度耐力训练；③ 加强体育锻炼
- 主要指标：术后并发症
- 次要指标：固定式脚踏车测力计的持续时间(endurance time, ET)

	术前校正的Charlson指数	并发症比例%	每人并发症数	ΔET%
对照组 (n=63)	7 (8)	62	1.4	12.1
干预组 (n=62)	7 (9)	31	0.5	135
	P> 0.05	*P* = 0.001	*P*= 0.001	*p*<0.001

Anael Barberan-Garcia et al. Annals of surgery. 2018

Preoperative biliary drainage
术前减黄

- Summary and recommendation: Preoperative endoscopic biliary drainage should not be carried out routinely in patients with a serum bilirubin concentration <250 mmol/l.
- 总胆250以下，不常规减黄

- Evidence level: Moderate.
- Recommendation grade: Weak.

术前营养支持

- **术前有营养不良患者，应给予营养支持（1A）**
- 一项纳入800例胃癌手术患者的研究（2006.4-2013.12）显示：
  - ✓ 术前营养不良者占19.0%，其手术部位感染率（ surgical site infections, SSIs）显著高于无营养不良组(35.5 vs. 14.0 %，p＜0.0001);
  - ✓ 营养不良患者中，接受了充足营养支持（至少10天的目标能量供应）患者，SSIs发生率显著低于未接受充足营养支持患者（能量不足或少于10天）(17.0% vs. 45.4%, p ＜ 0.00069);
  - ✓ 多因素分析发现，良好的营养干预是降低术后SSIs发生的独立保护因素（odds ratio 0.14, 95%CI 0.05-0.37, p=0.0002）.

Fukuda Y, et al. Ann Surg Oncol. 2015

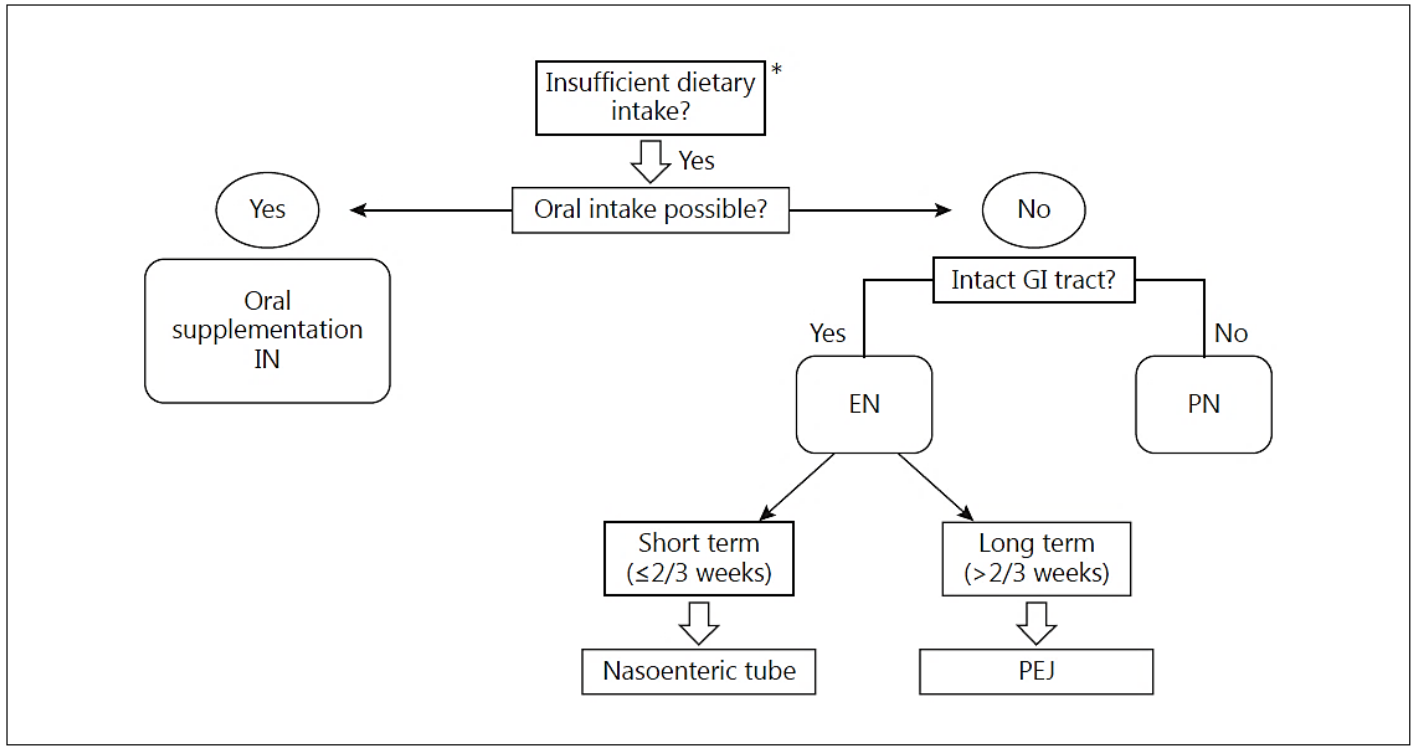
术前营养支持

- 术前营养支持可能不会降低无营养不良患者的术后并发症
- 一项纳入1085例择期腹部手术患者的前瞻性多中心队列研究（2007.3-2008.7), NRS 2002 方法，结果:
  - ✓ 营养风险(NRS score ⩾ 3)： 47.2%（512例)
  - ✓ 严重营养风险(NRS score ⩾ 5) : 120例，其中接受术前营养干预者的手术并发症率显著低于未接受营养者（ 25.6% vs. 50.6%, p = 0.008), 且术后住院时间明显缩短(13.7± 7.9 vs. 17.9 ± 11.3 d, P = 0.018).
  - ✓ NRS score 3~4 患者，392例，有无术前营养支持组间的术后并发症和住院时间无差异

Jie B, et al. Nutrition. 2012

营养支持方式

- 首选肠内营养：经口营养补充（ONS）或存在摄入障碍者管饲肠内营养（EN）



Robert G. Martindale, et al. JPEN. 2013

Fig. 1. Decision algorithm for the delivery route of perioperative nutrition in patients undergoing surgery for GC. * Oral food intake <500 kcal/day or ≤75% of the requirement for more than 1–2 weeks [17]. GI = Gastrointestinal; PEJ = percutaneous endoscopic jejunostomy.

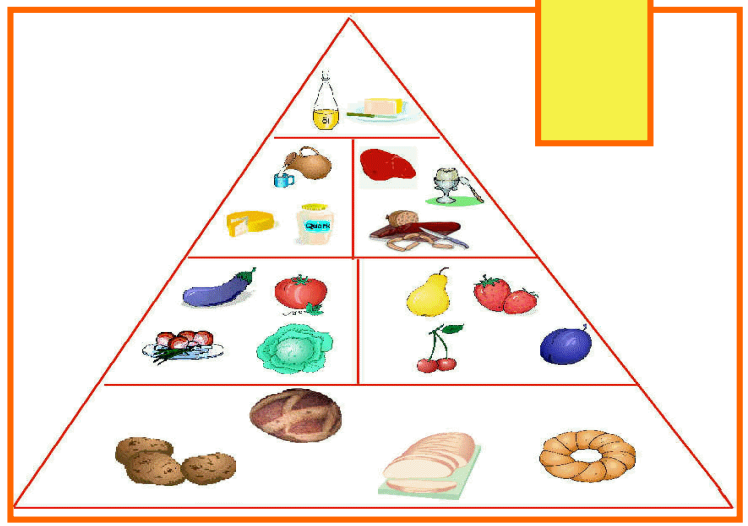
Preoperative nutrition
术前营养支持

- Summary and recommendation: Routine use of preoperative artificial nutrition is not warranted, but significantly malnourished patients should be optimized with oral supplements or enteral nutrition preoperatively.

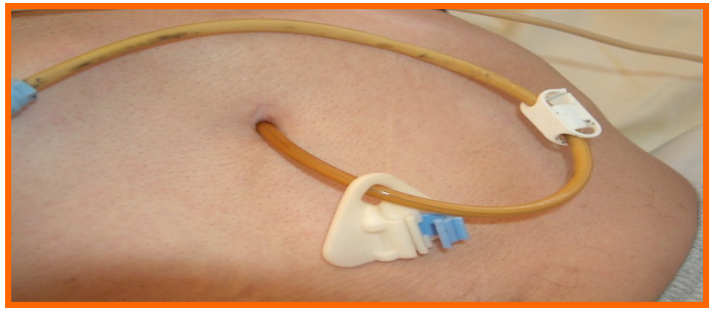
- **不常规营养支持**
- **存在营养不良者建议肠内营养优先**

- Evidence level: Very low.
- Recommendation grade: Weak.

术前营养支持内容



推荐营养素供应



Perioperative oral immunonutrition (IN) 免疫营养

- Summary and recommendation: The balance of evidence suggests that IN for 5-7 days perioperatively should be considered because it may reduce the prevalence of infectious complications in patients undergoing major open abdominal surgery.

- **术前予5-7天的免疫营养，降低感染风险**

- Evidence level: Moderate.
- Recommendation grade: Weak

免疫调节配方的应用与发展

- E2：建议在MICU不常规使用免疫调节型肠内营养制剂（精氨酸、二十碳五烯酸[EPA]、二十二碳六烯酸[DHA]、谷氨酰胺与核苷酸）。上述制剂可用于颅脑创伤与SICU围术期患者
- L2：建议重症急性胰腺炎患者开始EN时选择标准聚合物配方制剂。现有证据虽然令人鼓舞，但尚不足以推荐重症急性胰腺炎患者应用免疫增强配方EN
- M1b：建议严重创伤患者给予富含精氨酸与鱼油的免疫调节配方肠内营养
- M2b: 基于专家共识，建议TBI患者使用含有精氨酸的免疫调节配方，或使用添加EPA/DHA的标准配方
- N5：建议严重全身性感染患者不常规使用免疫调节配方的EN制剂
- O3：需要EN治疗的SICU术后患者，建议常规给予免疫调节配方肠内营养制剂（含精氨酸与鱼油）

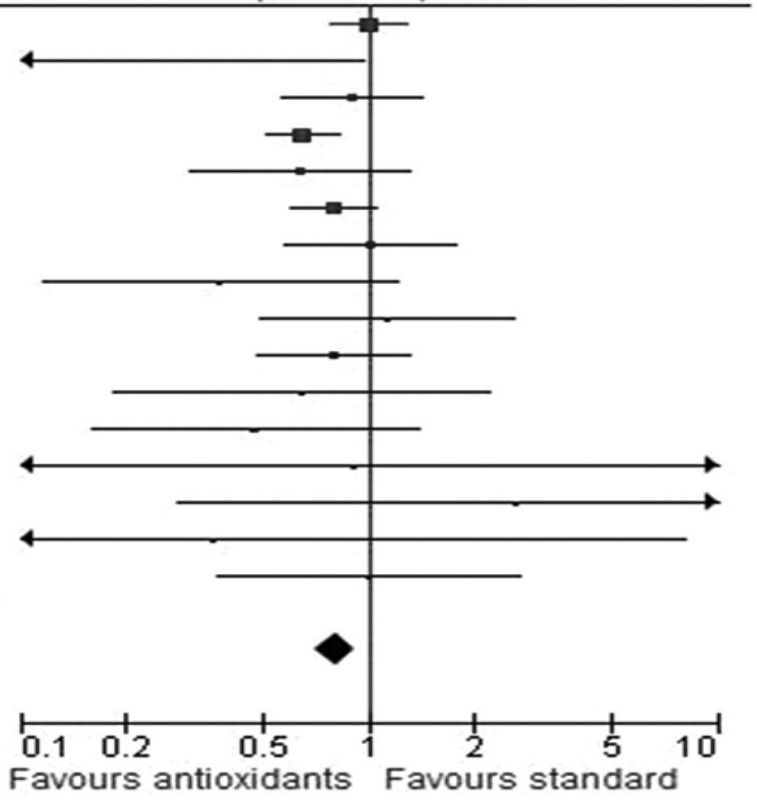
Taylor BE, McClave SA, Martindale RG, et al. Crit Care Med 2016; 44: 390-438A

Antioxidants vs standard, outcome mortality

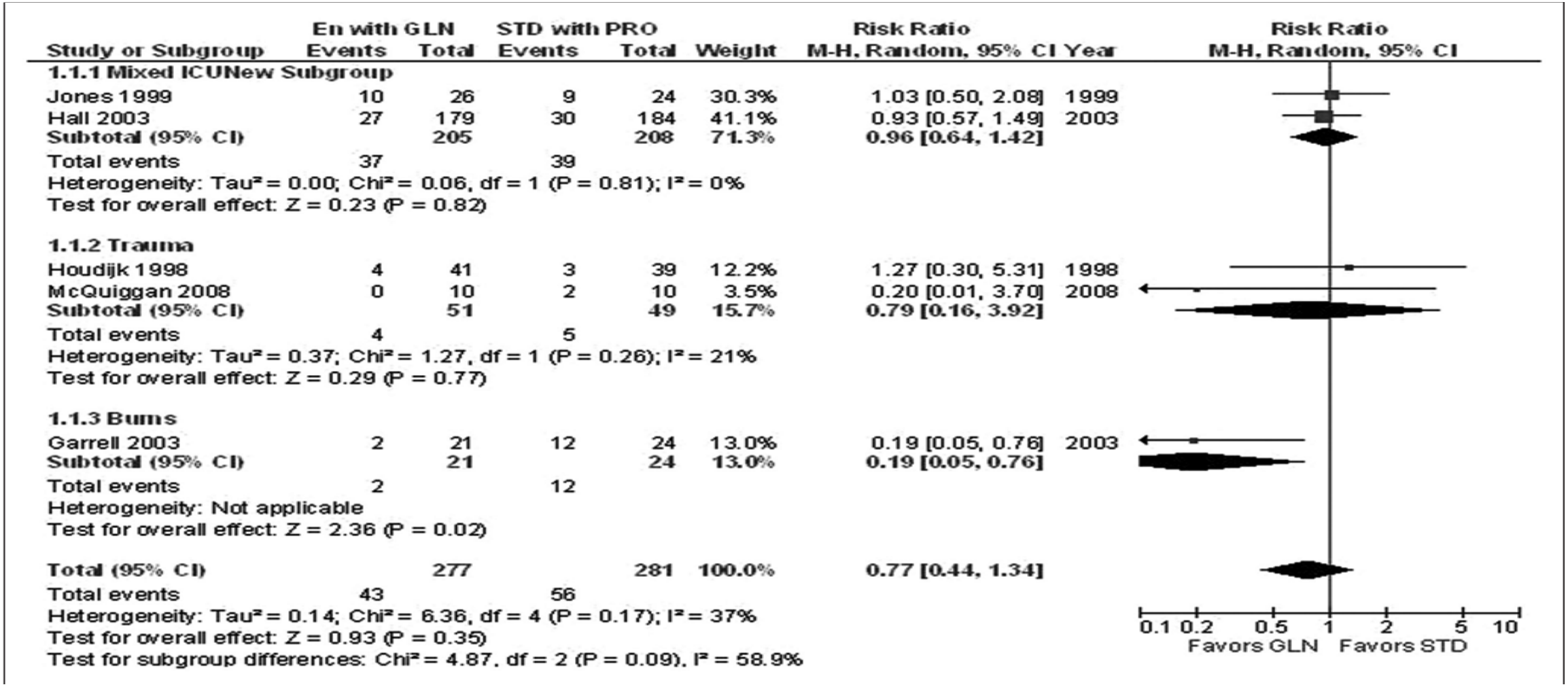
Study or Subgroup	Antioxidants Events	Total	standard Events	Total	Weight	Risk Ratio M-H, Random, 95% CI
Andrews, 2011	84	251	84	251	24.5%	1.00 [0.78, 1.28]
Kuklinski, 1991	0	8	8	9	0.2%	0.07 [0.00, 0.98]
Mishra, 2007	11	18	15	22	7.7%	0.90 [0.56, 1.43]
Crimi, 2004	49	112	76	112	24.7%	0.64 [0.50, 0.82]
Angstwurm, 1999	7	21	11	21	3.2%	0.64 [0.31, 1.32]
Angstwurm, 2007	46	116	61	122	18.9%	0.79 [0.60, 1.06]
Forceville, 2007	14	31	13	29	5.4%	1.01 [0.58, 1.76]
Zimmerman, 1997	3	20	8	20	1.3%	0.38 [0.12, 1.21]
Preiser, 2000	8	20	6	17	2.5%	1.13 [0.49, 2.62]
Valenta, 2011	19	75	24	75	6.5%	0.79 [0.48, 1.32]
Manzanares, 2011	3	15	5	16	1.1%	0.64 [0.18, 2.22]
Young, 1996	4	33	9	35	1.5%	0.47 [0.16, 1.38]
Berger, 2007	1	11	1	10	0.3%	0.91 [0.07, 12.69]
Berger 2001a	2	9	1	12	0.3%	2.67 [0.28, 25.04]
Berger 2001b	0	11	1	12	0.2%	0.36 [0.02, 8.04]
Schneider, 2011	6	29	6	29	1.7%	1.00 [0.37, 2.74]
Total (95% CI)		**780**		**792**	**100.0%**	**0.80 [0.70, 0.92]**
Total events	257		329			

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 15.56$, $df = 15$ ($P = 0.41$); $I^2 = 4\%$

Test for overall effect: $Z = 3.27$ ($P = 0.001$)



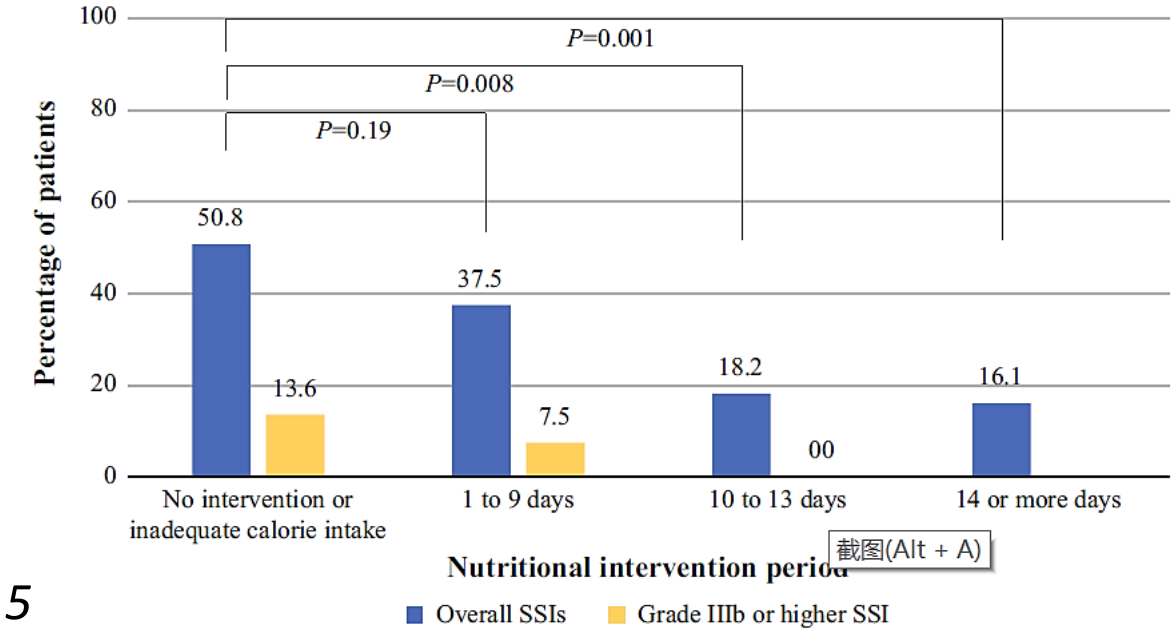
Enteral nutrition (EN) glutamine (GLN) vs control by subgroups, mortality.



术前营养支持时间

- 术前营养支持治疗时间一般为7~10 d，严重营养不良者可能需要更长时间
- 一项关于胃癌手术患者的研究显示：
  - ✓术前营养不良患者中，营养支持时间不足10天者，其SSIs发生率显著高于接受营养支持10天以上者

择期手术，改善营养，值！



Fukuda Y, et al. Ann Surg Oncol. 2015

术前肠道准备

不推荐包括结直肠手术在内的腹部手术病人常规进行机械性肠道准备

	腹腔并发症%	吻合口瘘%	腹腔外并发症%	住院时间
肠道准备组(n=78)	22	5	24	14.9
无肠道准备组(n=75)	8	1	11	9.9
	$p<0.05$	$p<0.05$	$p<0.05$	$p<0.05$

左半结肠切除一期吻合病人153例

肠道准备组：术前口服3000ml聚乙二醇

结论：择期左半结肠切除不行肠道准备是安全的，可降低术后并发症发生率

Bucher P, et al. Br J Surg, 2005, 92(4):409–414.

术前禁食及口服碳水化合物

- 建议禁饮时间延后至术前2 h；禁食时间延后至术前6 h
- 胃排空延迟、胃肠蠕动异常和急诊手术病人除外
- 缩短术前禁食时间[1]：
  - 有利于减少手术前病人的饥饿、口渴、烦躁、紧张等不良反应
  - 有助于减少术后胰岛素抵抗，缓解分解代谢
  - 甚至可缩短术后住院时间

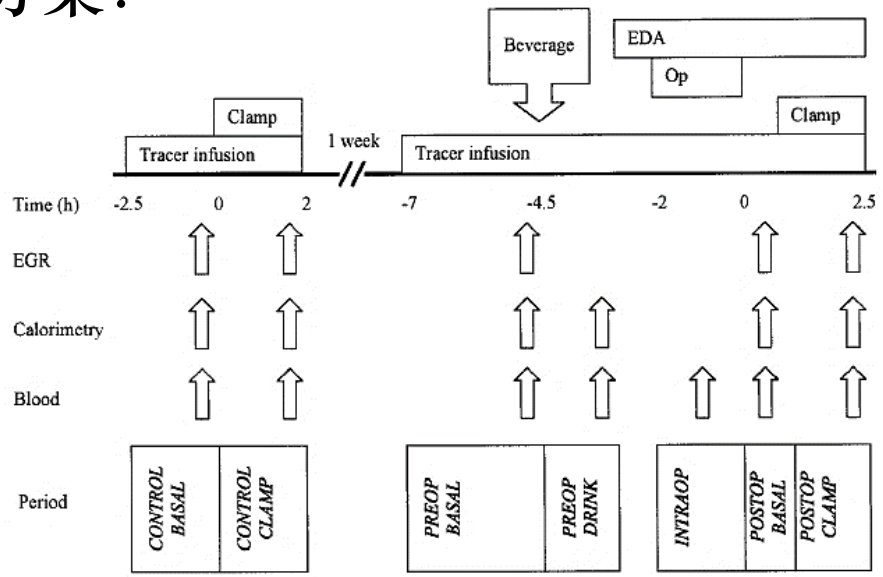
➢一项纳入36例行择期结肠切除患者的RCT研究结果[2]：

	术后住院时间 d	术后首次排气 d	术后肠蠕动开始 d
禁食组(n=12)	13	3	4
口服清水组(n=11)	10	3	5
口服糖盐水组(n=12)	7.5	1.5	3

1. *Nygren J, et al. Curr Opin Anaesthesiol. 2015*
2. *2. S. E. Noblett, et al. Colorectal Disease.2006*

术前糖负荷

- 术前口服葡萄糖溶液可改善胃肠术后的胰岛素抵抗及炎症反应
- 针对择期行全髋关节置换手术患者的研究：15例（8例糖负荷+7例对照）
- 研究方案：



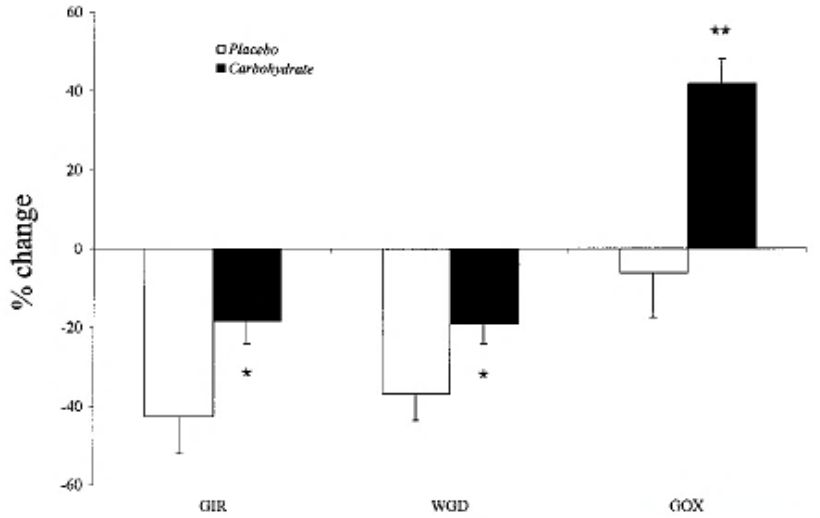
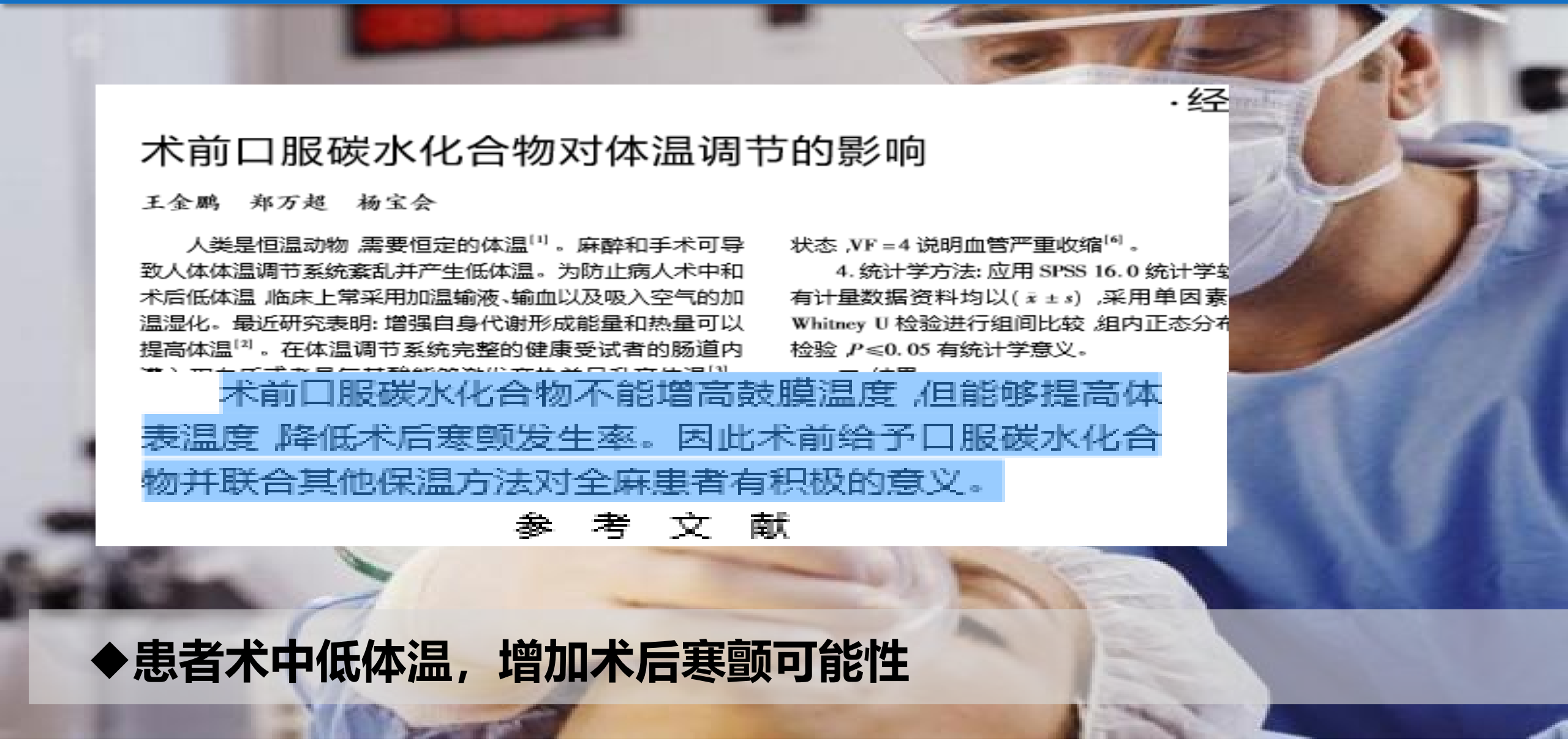


Fig. 2. Relative change (*postop* vs. *control clamp*) in glucose infusion rates (GIR), whole body glucose disposal rates (WGD), and glucose oxidation rates (GOX) in patients undergoing total hip replacement surgery pretreated with a carbohydrate-rich beverage ($n = 8$) (carbohydrate) or placebo ($n = 7$) (placebo). $^{*}P < 0.05$; $^{**}P < 0.01$ vs. placebo.

Soop M, et al. Am J Physiol Endocrinol Metab. 2001

对麻醉医生来说术前长时间禁食影响体温



·经

术前口服碳水化合物对体温调节的影响

王金鹏　郑万超　杨宝会

人类是恒温动物 需要恒定的体温[1]。麻醉和手术可导致人体体温调节系统紊乱并产生低体温。为防止病人术中和术后低体温 临床上常采用加温输液、输血以及吸入空气的加温湿化。最近研究表明: 增强自身代谢形成能量和热量可以提高体温[2]。在体温调节系统完整的健康受试者的肠道内

状态 ,VF =4 说明血管严重收缩[6]。

4. 统计学方法: 应用 SPSS 16.0 统计学软
有计量数据资料均以($\bar{x} \pm s$) ,采用单因素
Whitney U 检验进行组间比较 ,组内正态分布
检验 $P \leqslant 0.05$ 有统计学意义。

术前口服碳水化合物不能增高鼓膜温度 ,但能够提高体表温度 ,降低术后寒颤发生率。因此术前给予口服碳水化合物并联合其他保温方法对全麻患者有积极的意义。

参　考　文　献

◆患者术中低体温，增加术后寒颤可能性

美国麻醉医师学会推荐术前2h可饮用清流食

ASA术前禁食指南（2011版）

SPECIAL ARTICLES

Practice Guidelines for Preoperative Fastin
of Pharmacologic Agents to Reduce the R
Pulmonary Aspiration: Application to Healt
Undergoing Elective Procedures

An Updated Report by the American Society of A
Committee on Standards and Practice Paramete

PRACTICE Guidelines are systematically developed recommendations that assist the practitioner and patient in making decisions about health care. These recommendations may be adopted, modified, or rejected according to clinical needs and constraints and are not intended to replace

ments, and their use cannot
Practice Guidelines are sub
the evolution of medical kn
tice. They provide basic recommendations that are sup-
ported by a synthesis and analysis of the current literature,

空腹建议摘要

Summary of Fasting Recommendations

Ingested Material	Minimum Fasting Period
Clear liquids	2 h
Breast milk	4 h
Infant formula	6 h
Nonhuman milk	6 h
Light meal	6 h

含糖的清流食

ASA术前禁食指南（2011版）

Preoperative Fasting Status术前禁食状态	
Clear liquids（不含酒精，含少量糖）如清水、清茶、黑咖啡、果汁、碳酸饮料等	术前2-4小时或更久
固体食物	术前4-8小时或更久
奶制品（母乳）	术前2-4小时或更久
奶制品（婴幼儿配方奶粉）	术前2-4小时或更久
奶制品（非人乳和配方奶）	术前4-8小时或更久

克利夫兰特邀述评：术前碳水化合物负荷

Invited Review

Nutrition in Clinical Practice
Volume 30 Number 5
October 2015 660–664
© 2015 American Society
for Parenteral and Enteral Nutrition
DOI: 10.1177/0884533615594013
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Review of Preoperative Carbohydrate Loading

Cassandra Pogatschnik, RD, LD, CNSC[1]; and Ezra Steiger, MD, FACS, FASPEN[1]

Abstract

Preoperative carbohydrate-containing clear liquids (usually composed of approximately 12% carbohydrate predominantly in maltodextrin form) have provided benefits for the surgical population and further have been included in the Enhanced Recovery After Surgery (ERAS) Society's recommendations as part of a multimodal approach to reduce surgical patients' length of stay and complication rates. Carbohydrate metabolism is greatly affected by the fed state, which is activated by preoperative carbohydrate fluids given up to 2 hours prior to surgery in contrast to the traditional midnight preoperative fast. Carbohydrate-rich fluids have been proven to enhance patient comfort prior to surgery and have been theorized to reduce insulin resistance, reducing patient catabolism, with a positive impact on perioperative glucose control and muscle preservation. This practice is further hypothesized to support the ERAS goals of reducing both complication rate and length of stay. Preoperative carbohydrate fluid loading is difficult to prove, as the degree of surgical procedure and postoperative pathways are likely more reflective of patient outcome. The use of carbohydrate-loading protocols warrants further adequately blinded, placebo-controlled studies, including the use of variable surgical techniques, reproduction of the hyperinsulinemic euglycemic technique measurements, investigation of ideal carbohydrate fluid composition, and the use of similar surgeries in comparison. Preoperative carbohydrate loading is just one of the many strategies linked to the success of ERAS protocols. (*Nutr Clin Pract*. 2015;30:660-664)

术前使用含碳水化合物的液体（通常碳水化合物占12%，主要是麦芽糊精）可为手术患者带来益处，被快速康复外科（ERAS）协会推荐作为综合治疗方案的一部分，与传统的术前午夜禁食相反，**术前2小时给予碳水化合物液体可激活碳水化合物代谢。**

ERAS术后营养规范化管理

- 术后进食时间
- 进食途径选择
- 进食内容选择
- 营养-膳食过渡
- 出院后指导-家庭营养支持

术后早期营养干预

择期腹部手术术后尽快恢复经口进食水及口服营养素：

- 可促进肠道运动功能恢复；
- 维护肠粘膜功能；
- 防止菌群失调和异位；
- 可降低感染风险及术后并发症发生率；
- 缩短住院时间；
- 不增加吻合口瘘发生率

赵玉沛：加速康复外科中国专家共识及路径管理指南（2018 版）

术后营养支持时机

- 术后24～48h内，内稳态得到稳定后即可进行；
- 病人生命体征平稳后，按照适应证和使用规范进行；
- 大手术后（如whipple术后）不宜过早给予肠外营养；

专家共识：应根据患者的胃肠道功能和耐受能力决定术后早期进食或EN的开始时间和剂量（1A）

- 直肠或盆腔手术：术后4h可进水
- 结肠及胃手术：术后1d开始进食水
- 胰腺手术：根据患者耐受情况于术后3~4d恢复经口进食

中国加速康复外科围手术期管理专家共识（2016）

韦军民，老年患者围手术期营养支持策略

术后早期经口进食时机

前瞻性临床研究发现，择期腹部手术后早期经口进食是安全的，需要3~4d 时间逐渐增加饮食量；部分病人可给予管饲

Early Enteral Feeding Meta-Analyses

Author/Journal	Study Parameters	Study Design	Outcome
Marik, *CCM* 2001 (medical ICU patients)	Feeding < or > 36 hr	15 studies, 753 patients	↓ Infections ↓ LOS
Lewis, *BMJ* 2001 (surgery patients)	NPO vs <24 hr	11 studies, 837 patients	↓ Infections ↓ LOS ↑ Vomiting risk
Heyland *JPEN* 2003 (medical ICU patients)	<24-48 hr	8 studies	Trend to ↓ infections and mortality
Lewis SJ, *J GI Surg 2008* (surgery patients)	<24 hr	13 studies, 1173 patients	Decrease mortality
Doig GS, *Int Care Med 2009* (critically ill patients)	<24 hr	5 studies	Decrease infection and mortality
Osland E, *JPEN 2011* (GI surg with resection)	<24 hr	15 studies, 1240 patients	45% decrease in morbidity, no increase anastomotic leak
Doig GS, *Injury 2011* (trauma patients)	<24 hr	3 studies	Decrease mortality

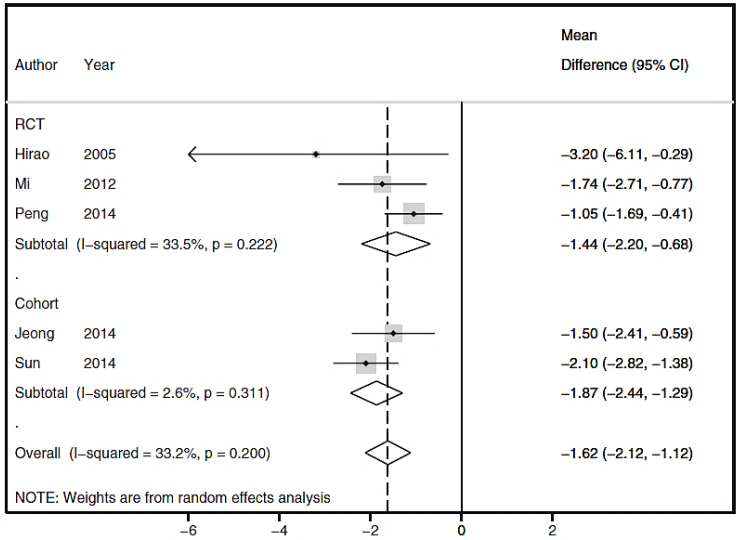
REV. perioperative nutrition.JPEN 2013

上消化道手术后早期经口进食

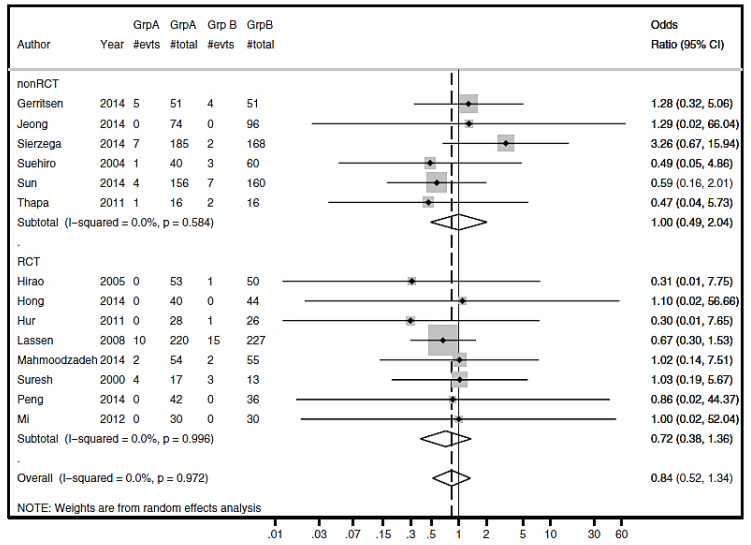
- 系统综述与meta分析：1980-2015年，15个研究，2112例上消手术患者（包含胰腺手术）
- 术后早期经口进食 VS. 传统延迟恢复进食
- 比较两组住院时间和并发症发生率

术后开始经口进食时间：

- 12/15个研究：POD1 or earlier
- 2/15：POD2
- 1/15 (食管癌患者)：POD3



术后住院时间平均缩短1.62天



术后吻合口瘘发生率无差异

Willcutts KF. et al. Ann Surg,2016,264(1):54-63

启动肠内营养：鸡汤？米汤？匀浆？FSMP？

匀浆型食物	商用型配方
营养含量未知	营养既全面又平衡
渗透压未知	需调节的渗透压较低
可能含有乳糖	不含乳糖和麸质
灭菌质量不佳	杀菌消毒达到商业要求
粘度很高	管道的流动性极好

2012年中国食物成分表——瓦罐鸡汤营养成分

（以每100g可食部计）

营养成分	含量	营养成分	含量
可食部分%	100.00	硫胺素/mg	0.01
水分/g		核黄素 /mg	0.07
能量/kcal	27	维生素E /mg	0.21
蛋白质/g	1.3	钠 /mg	251.4
脂肪/g	2.4	钙 /mg	2.0
碳水化合物/g	0	铁 /mg	0.3
胆固醇/mg	24.0	备注	产地武汉

Campbell SM．Nutr Clin Pract 2006；21：411-415．

口服营养补充(ONS)推荐

中华胃肠外科杂志 2017 年 4 月第 20 卷第 4 期 Chin J Gastrointest Surg, April 2017, Vol.20, No.4

·指南与共识·

成人口服营养补充专家共识

中华医学会肠外肠内营养学分会

推荐4b：预计围手术期不能正常进食超过5～7 d，或口服进食少于推荐目标量热卡和蛋白质的60%时，术前应给予ONS

推荐4d：术后早期恢复经口进食不能满足机体营养需求患者，推荐实施ONS支持，以增加热卡及蛋白质的摄入量

推荐5b：术后ONS应用至患者能恢复正常饮食，日常膳食摄入达到机体营养物质的目标量时再停用

推荐6：推荐剂量为饮食加ONS达到推荐机体日常能量及蛋白质需要量，或除日常饮食外ONS至少达到400—600 kcal/d

ONS能改善体重减轻患者的临床结局

- 多中心、单盲RCT（2013.11-2015.2）
- 术前体重减轻＞1kg/3~6月的结直肠癌患者
- 干预组n=55：250 ml/d ONS (10.1 KJ+0.096 g Pro per ml)+饮食指导（术前至少5天）
- 对照组n=45：饮食指导
- 主要指标：手术部位感染（SSIs）或胸部感染
- 次要指标：体重减轻、总并发症、体成分改变

	Energy (KJ) Median (IQR)			Protein (g) Median (IQR)		
Time point *n* = participants	Control	ONS	*P*-value	Control	ONS	*P*-value
Baseline *n* = 93	6085(4743–7493)	6407 (4233–8193)	0.760	68 (48–83)	57 (41–76)	0.271
Pre-operative *n* = 70	6350 (4714–6350)	8120 (6490–9831)	0.001	63 (49–78)	79 (67–97)	0.018
Post-operative *n* = 89	4499 (3218–6416)	5302 (3973–7173)	0.282	46 (31–70)	60 (43–70)	0.181

IQR, interquartile range; ONS, oral nutritional supplement.
Mann–Whitney U-tests.

Burden ST, et al. J Cachexia Sarcopenia Muscle, 2017.

术前ONS有助于改善体重减轻的结直肠癌患者的感染及体重丢失情况

◆ 感染(SSI或胸部感染)率：干预组 17/55(30%); 对照组 21/45(47%);
校正分析，OR=0.341 (P=0.031, CI 0.128-0.909)

Table 3 Intention to treat analysis for number of participants with chest, surgical site, or urinary tract infections

	Control		Intervention		
	n = 45(%)	95% CI	*n* = 55(%)	95% CI	*P*-value
Surgical site infection	17 (38)	25.1 to 52.4	11 (20)	11.6 to 32.4	[a]0.044
Chest infection	3 (7)	2.3 to 17.9	5 (9)	3.9 to 19.6	[b]0.359
Urinary tract infection	6 (13)	6.3 to 26.2	4 (7)	2.9 to 17.3	[a]0.315

◆ 体重减轻：手术前与手术后，干预组均明显低于对照组

	24–48 h pre-operative				5–7 days post-operative			
	n	Control	ONS	*P*-value	*n*	Control	ONS	*P*-value
Handgrip mean (SD)	70	25.0 (8.52)	25.2 (10.07)	0.723	70	23.2 (7.85)	24.9 (9.89)	[a]0.394
Percentage weight loss median (IQR)	73	6.7 (2.6–10.8)	4.1 (1.7–7.0)	0.021	79	10.2 (5.1–18.5)	7.4 (4.3–10.0)	[b]0.016
PG-SGA score median (IQR)	69	6.5 (3.0–9.7)	4.0 (2.0–9.0)	0.215	72	12.0 (8.0–15.0)	10.0 (6.5–13.5)	[b]0.062

Burden ST, et al. J Cachexia Sarcopenia Muscle, 2017.

Postoperative glycaemic control
术后血糖控制

- Summary and recommendation: Insulin resistance and hyperglycaemia
- are strongly associated with postoperative morbidity and mortality. Treatment of hyperglycaemia with intravenous insulin in the intensive-care setting improves outcomes but hypoglycaemia remains a risk. Several ERAS protocol items attenuate insulin resistance and facilitate glycaemic control without the risk of hypoglycaemia. Hyperglycaemia should be avoided as far as possible without introducing the risk of hypoglycaemia.
- 控制高血糖，避免低血糖

- Evidence level: Low.
- Recommendation grade: Strong.

Nasogastric intubation
胃肠减压

- Summary and recommendation: Pre-emptive use of nasogastric tubes postoperatively does not improve outcomes and their use is not warranted routinely.

- **胃肠减压不改善临床结局，不常规推荐**

- Evidence level: Moderate.
- Recommendation grade: Strong.

Perianastomotic drains
引流管

- Summary and recommendation: Early drain removal after 72 h may be advisable in patients at low risk (i.e., amylase content in drain <5000 U/L) for developing a pancreatic fistula. There is insufficient evidence to recommend no routine use of drains routinely, but their use is based only on low-level evidence.
- 胰漏低风险（引流AMY < 5000）者72h后早期拔除引流
- 不常规放置引流证据不足，放置证据较低

- Evidence level.
- Early removal: High.
- Recommendation grade.
- Early removal: Strong.

Somatostatin analogues
生长抑素

- Summary and recommendation: Somatostatin and its analogues have no beneficial effects on outcome after PD. In general, their use is not warranted. Subgroup analyses for the variability in the texture and duct size of the pancreas are not available.

- **PD后生长抑素使用无获益，胰漏发生粗率降低，但整体漏、死亡率无差异（Meta，17 trail，PTS 1457）**

- Evidence level: Moderate.
- Recommendation grade: Strong.

Delayed gastric emptying (DGE)
胃排空延迟

- Summary and recommendation: There are no acknowledged
- strategies to avoid DGE. Artificial nutrition should be considered selectively in patients with DGE of long duration.
- 10-25%
- 胃瘫无好策略，加用营养支持

- Evidence level: Very low.
- Recommendation grade: Strong.

EN不能/不足怎么办?

- **术后肠外营养支持：**对于禁止接受肠内营养或不能耐受肠内营养的营养不良患者有益。A

- **接受术后肠外营养支持有益：**患者出现术后并发症，胃肠道功能出现损害，7天内不能接受或者经口进食或肠内营养支持不能达到能量需求。A

M. Braga, O. Ljungqvist, P. Soeters, et al. ESPEN Guidelines on Parenteral Nutrition:Surgery. Clinical Nutrition, 2009 (28), 378–386

SCCM和ASPEN关于PN应用推荐意见

- **问题：低营养风险的成年危重病患者，何时应开始PN?**

低营养风险（如：NRS-2002≤3或NUTRIC评分≤5）、不适宜早期EN、且入ICU 7天仍不能保证经口摄食量的患者，7天后给予PN支持。

- **问题：高营养风险的危重病患者，何时开始PN?**

高营养风险（如：NRS-2002≥5或NUTRIC评分 ≥6）或严重营养不良患者，如果EN不可行，建议入ICU后尽早开始PN。无论低或高营养风险患者，接受EN 7-10天不足目标的60%者，应考虑SPN。[证据质量：中]

- **问题：成年危重病患者提高PN有效性的策略是什么?**

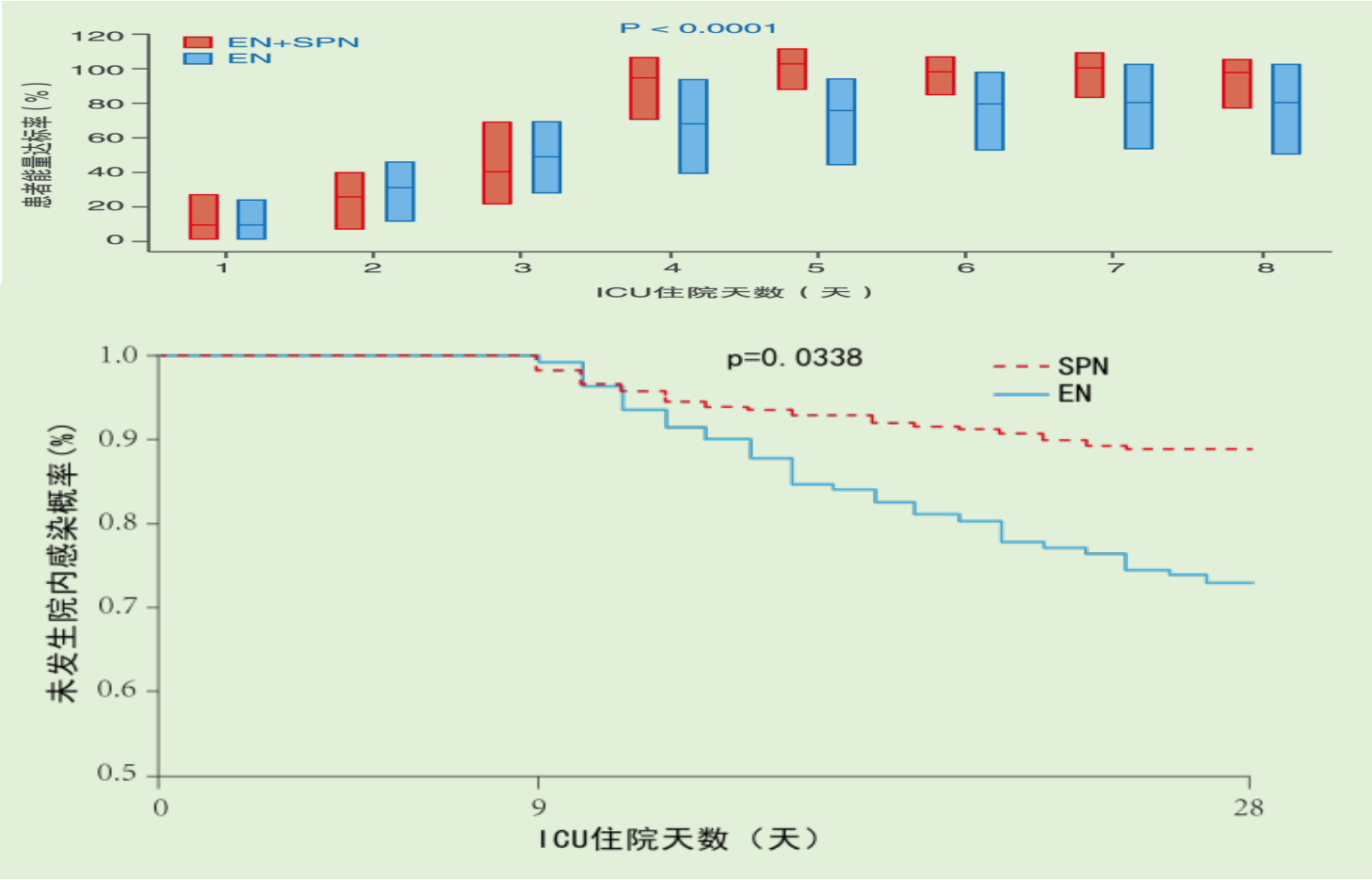
建议使用营养支持实施方案与营养支持小组，以促进营养支持策略的最大化获益并降低PN相关风险。

- **问题：对于具有PN适应症的患者（高风险或严重营养不良），住ICU第一周应如何调整营养供给量?**

高营养风险或严重营养不良、需要PN支持的患者，建议住ICU第一周内给予低热卡PN（≤20 kcal/kg/day 或能量需要目标的80%），以及充分的蛋白质补充（≥ 1.2 g/kg/day）。[证据质量：低]

Taylor BE, McClave SA, Martindale RG, et al. Crit Care Med 2016; 44: 390-438A

SPN 减少危重症患者院内感染率



Lancet 2013; 381: 385–93

RCT, ICU;

目标：25-30kcal/d

EN<60%+SPN

停留时间>5d;

存活时间>7d

No. NCT00802503

第9到28天经调整的院内感染概率: SPN 组显著低于EN组: 风险比 0.65 (95% CI 0.43-0.97; p=0.0338)

Heidegger CP, et al. Lancet. 2013 Feb 2;381(9864):385-93.

术后长期营养支持

术后营养不良能影响肿瘤病人的长期生存

- 2002-2013年 760例行胃癌根治手术患者（R0切除，Stage Ⅰ－Ⅲ）
- 营养评估方法： Nutrition risk index (NRI)
  - NRI ＞97.5 营养良好
  - NRI ⩽ 97.5 营养不良
- 比较两组间的总生存期（OS）和

  肿瘤特异生存期(CSS)

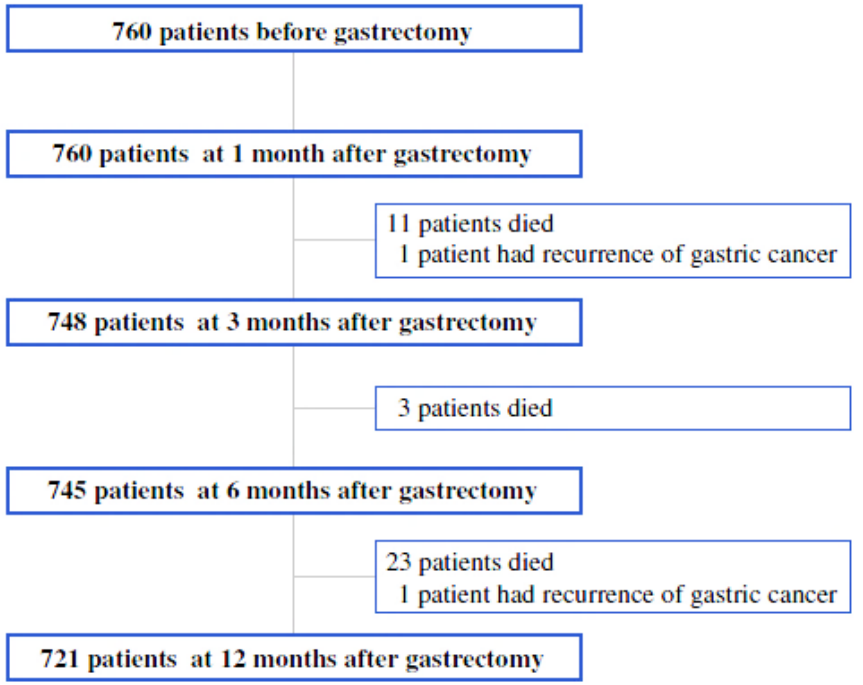


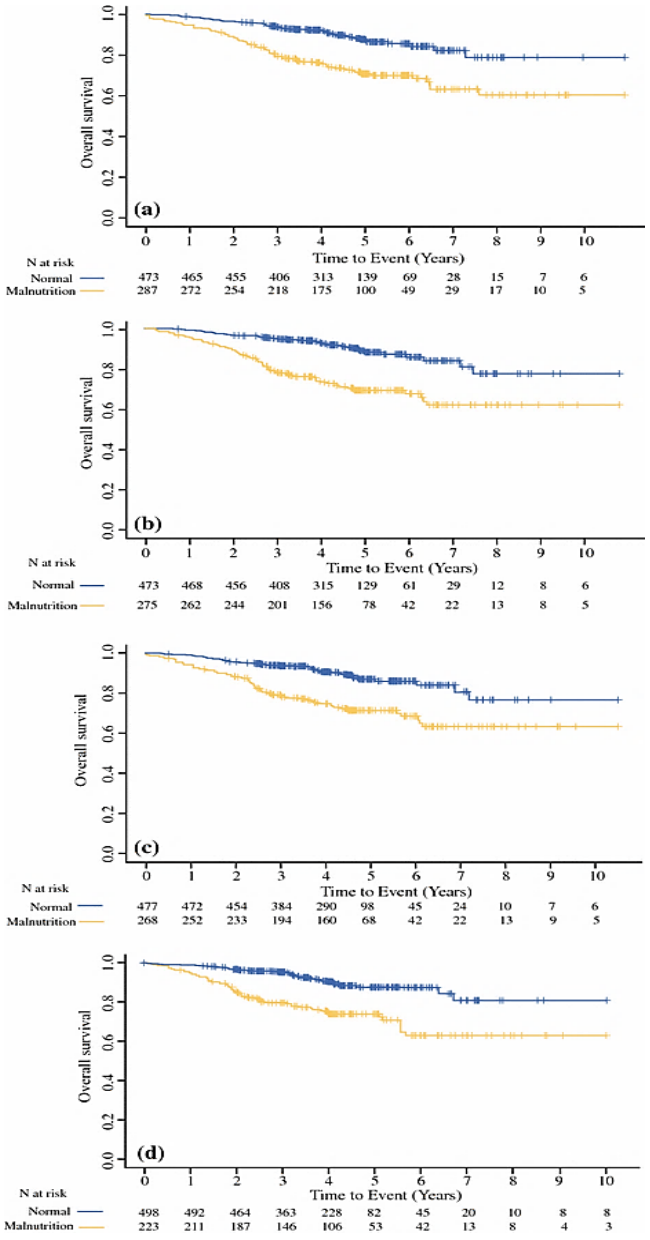
FIG. 1 Flowchart of enrolled patients before surgery and at 1, 3, 6 and 12 months after gastrectomy

Keiichi Fujiya, et al. Ann Surg Oncol. 2018

Overall survival curves for patients in the normal and malnutrition groups after gastrectomy. **OS according to nutrition status (NRI)**

胃癌手术后，营养良好患者的总生存期优于营养不良患者

Keiichi Fujiya, et al. Ann Surg Oncol. 2018



a at 1 month after gastrectomy (HR 2.62, 95% CI 1.87–3.67; $p < 0.001$)

b at 3 months after gastrectomy (HR 3.18, 95% CI 2.23–4.54; $p < 0.001$)

c at 6 months after gastrectomy (HR 2.73, 95% CI 1.91–3.89; $p < 0.001$)

d at 12 months after gastrectomy (HR 2.98, 95% CI 2.02–4.39; $p < 0.001$)

营养在ERAS方案中的应用经验

胃癌手术

- 日本一项单中心、前瞻性 II 期临床研究，共纳入2013.9-2014.9收治的121例胃癌根治术患者
- 主要观察指标： 术后严重并发症率（Clavien – Dindo II 级及以上）
- 次要观察指标：术后吻合口瘘及肺炎发生率、POD2恢复经口进食比例、ERAS方案实施情况、术后住院天数及30天再入院率、病死率
- 结果：术后严重并发症率10.7 % (90% CI, 6.47–16.54%)；术后吻合口瘘1例、肺炎0；平均术后住院日8天； ERAS方案完成率85.1%；30天再入院率和病死率0。

Sugisawa N, et al. Gastric Cancer. 2016

胃癌手术患者ERAS方案

	Day before surgery	Day of surgery			Day after surgery				
		Before operation	During operation	After operation	Day 1	Day 2	Day 3	Day 4	Day 5-10
Ambulation	Free	Free		Bed rest	Early mobilization	→	→	Free	→
Carbohydrate	90 g / 500 ml	45 g / 250ml							
Oral intake	Normal diet	Clear fluids up to 3 hour before anesthesia		Nothing	Clear fluids	Liquid diet	Soft meal	→	→
Transfusion			Fluid management	Crystalloids	Peripheral parenteral nutrition	→	→	Finish	
Bowel preparation	None								
Preanesthetic medication	None								
Antimicrobial prophylaxis			Before skin incision and every 3 h	Once					
Nasogastric tube			Insert	Remove					
Drainage tube			Insert	→	→	Remove			
Urinary catheter			Insert	→	→	→	Remove		
Epidural analgesia			Start	→	→	→	Finish		

结直肠手术

ERAS优化的 NutriCatt 方案对结直肠手术的影响：营养支持改善临床结局，提高经济学效益

NutriCatt protocol in the Enhanced Recovery After Surgery (ERAS) program for colorectal surgery: The nutritional support improves clinical and cost-effectiveness outcomes

研究目的：比较标准ERAS方案 vs ERAS+ NutriCatt 方案对结直肠手术患者临床结局的影响

研究对象：意大利Sacred Heart教会大学医院（2015.4-2016.1）收治的219例结直肠癌患者，ERAS组（n=114）vs ERAS+ NutriCatt（n=105）

Rinninella E, et al. Nutrition. 2018 Feb 5;50:74-81.

NutriCatt方案

Personalized diets at preadmission and before hospital admission

	Men	Women
At preadmission (2–3 wk)		
kcal	30 kcal/kg/d	25 kcal/kg/d
Proteins (g)	1.5 g/kg/d	1.5 g/kg/d
Lipids (% of kcal)	30	30
Carbohydrates (% of kcal)	45–55	45–55
Fibers	25–30 g/d, both soluble and insoluble	
3 d before admission		
Kcal	30 kcal/kg/d	25 kcal/kg/d
Proteins (g)	1.5 g/kg/d	1.5 g/kg/d
Lipids (% of kcal)	30	30
Carbohydrates	45–55	45–55
Fibers	10 g/d, soluble	

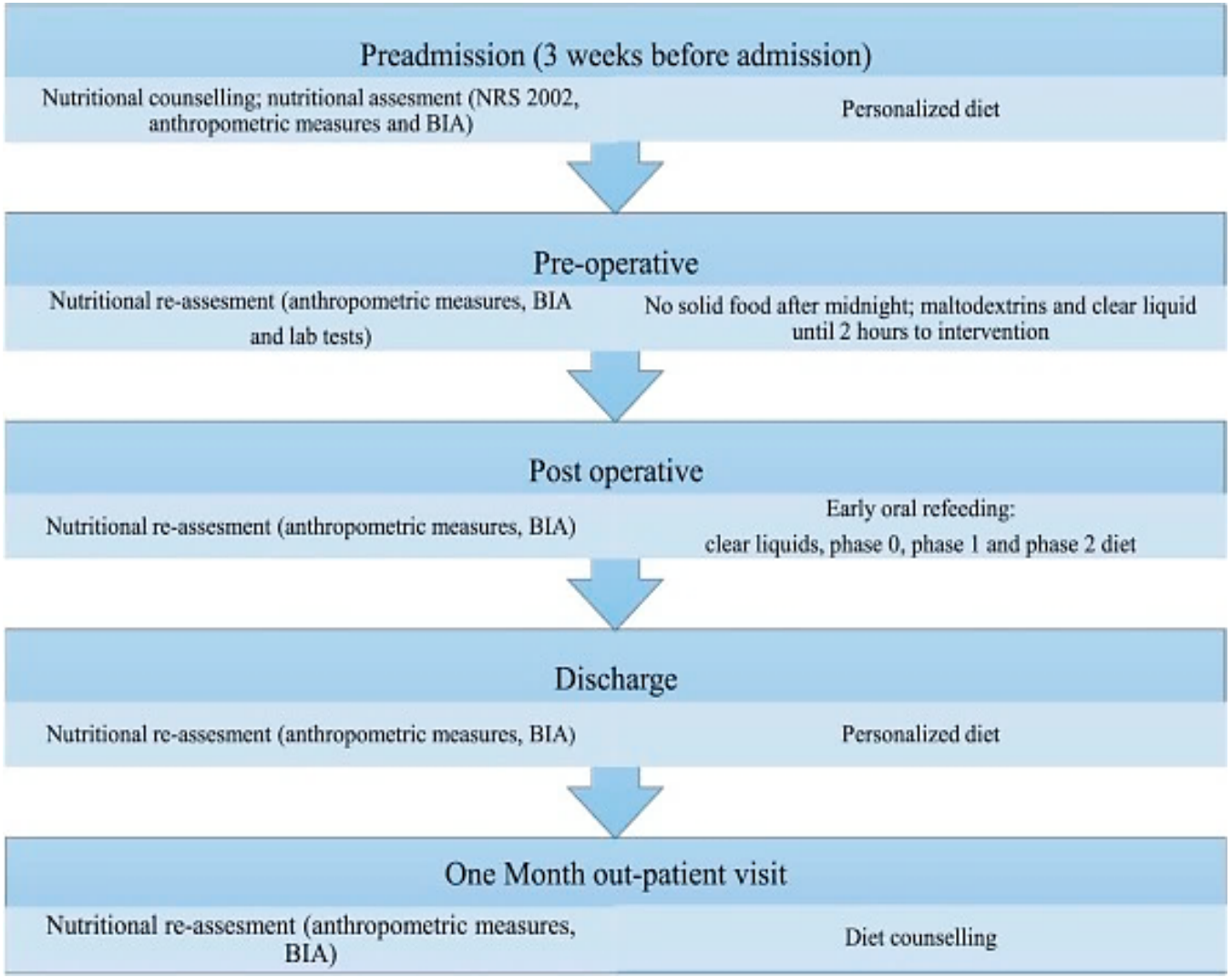
术前

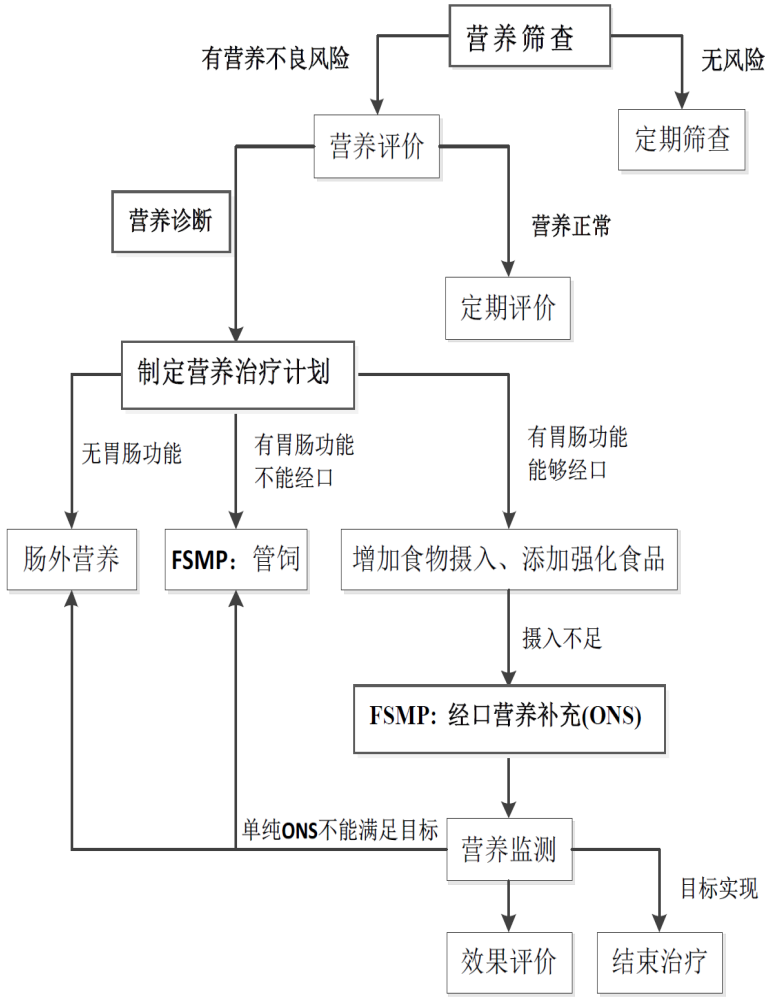
术后

Progressive dietary prescriptions from first postoperative day to discharge

	"Phase 0" Diet	"Phase 1" Diet	"Phase 2" Diet
Day postintervention	First day	Second day	From third day to discharge
kcal	1000 kcal	1450 kcal	1800 kcal
Proteins	13%	14%	18%
Lipids	30%	30%	30%
Carbohydrates	57%	56%	52%
Consistency	Liquid	Creamy, low residue	Semiliquid, only with soluble fiber

NutriCatt流程及评价





并发症及再入院情况

ERAS+NutriCatt 组 VS. ERAS组：
术后并发症发生率明显降低

	ERAS组		ERAS+NutriCatt 组		
	n	%	n	%	P值
术后总并发症	55	48.2	36	34.3	0.03
Grade I	22	19.3	18	17.1	
Grade II	23	20.2	12	11.4	
Grade IIIa	3	2.6	0	0	
Grade IIIb	6	5.3	4	3.8	
Grade IV	0	0	1	1	
Grade V	1	0.9	1	1	
30天内再入院	4	3.5	5	4.8	0.64
90天内并发症	4*	3.5	0	0	0.05

*4例并发症分别是：1例脓毒症多器官衰竭；2例剖腹探查，1例麻痹性肠梗阻

	ERAS组		ERAS+NutriCatt组	
	n	%	n	%
术后并发症	55	48.2	36	34.3
腹腔脓肿	4	3.5	1	0.95
伤口感染	5	4.4	3	2.9
肺炎	1	0.9	5	4.8
尿路感染	4	3.5	3	2.9
发热	4	3.5	1	0.95
败血症	1	0.9	0	0
吻合口漏	5	4.4	3	2.9
心血管并发症	1	0.9	3	2.9
Vesical globe	4	3.5	4	3.8
出血	3	2.6	1	0.95
恶心呕吐	9	7.9	3	2.9
肠梗阻	4	3.5	4	3.8
贫血	4	3.5	0	0
脱水	2	1.8	1	0.95
其他	4	3.5	4	3.8

ERAS+NutriCatt方案

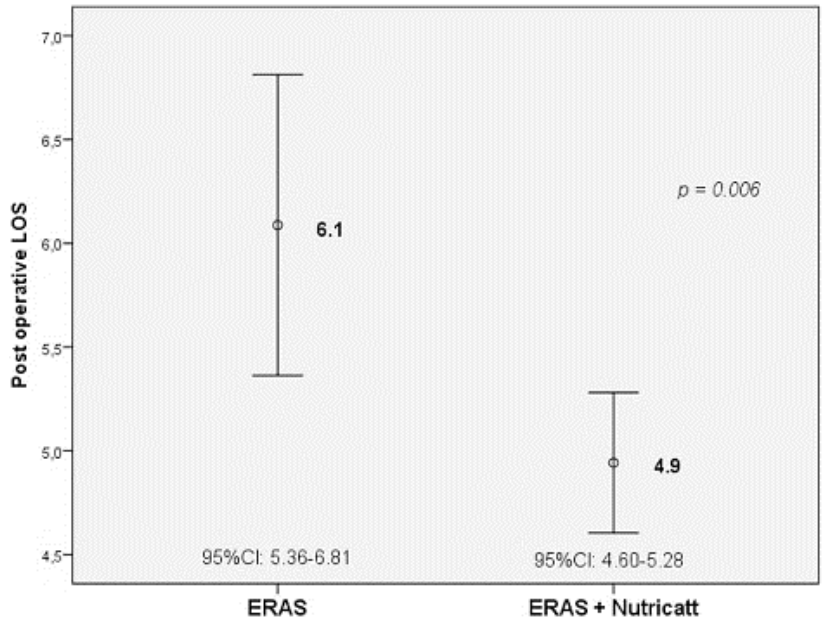
--围术期营养优化的ERAS方案

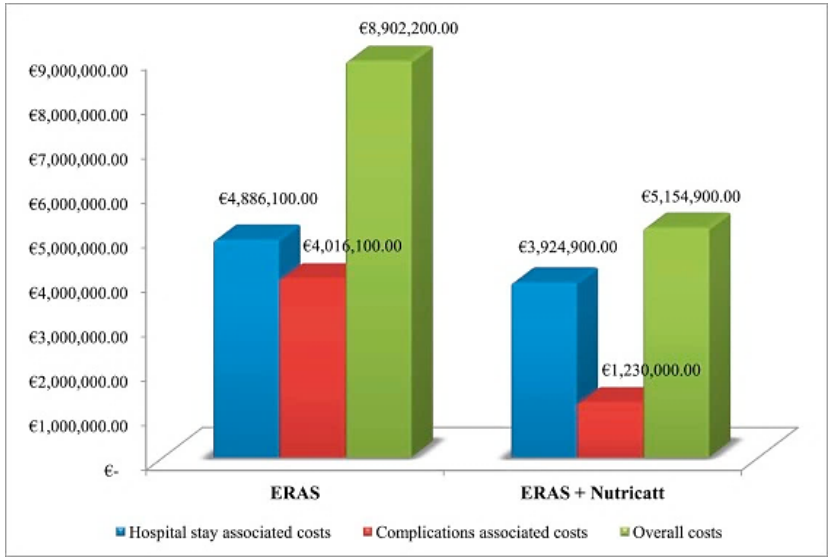
① 术后并发症减少

② 术后住院天数缩短

③ 住院总花费减少

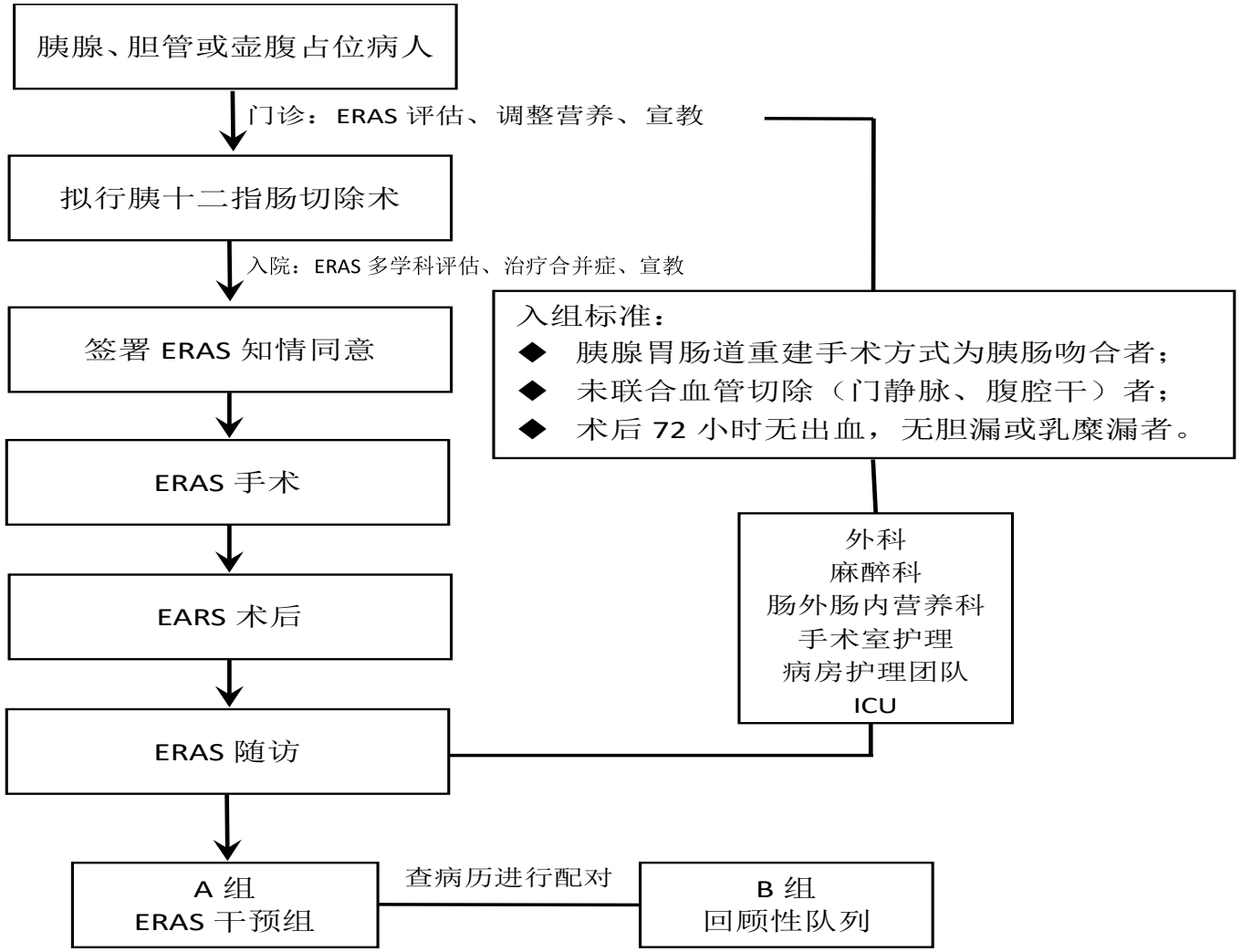
④ 药物相关花费减少



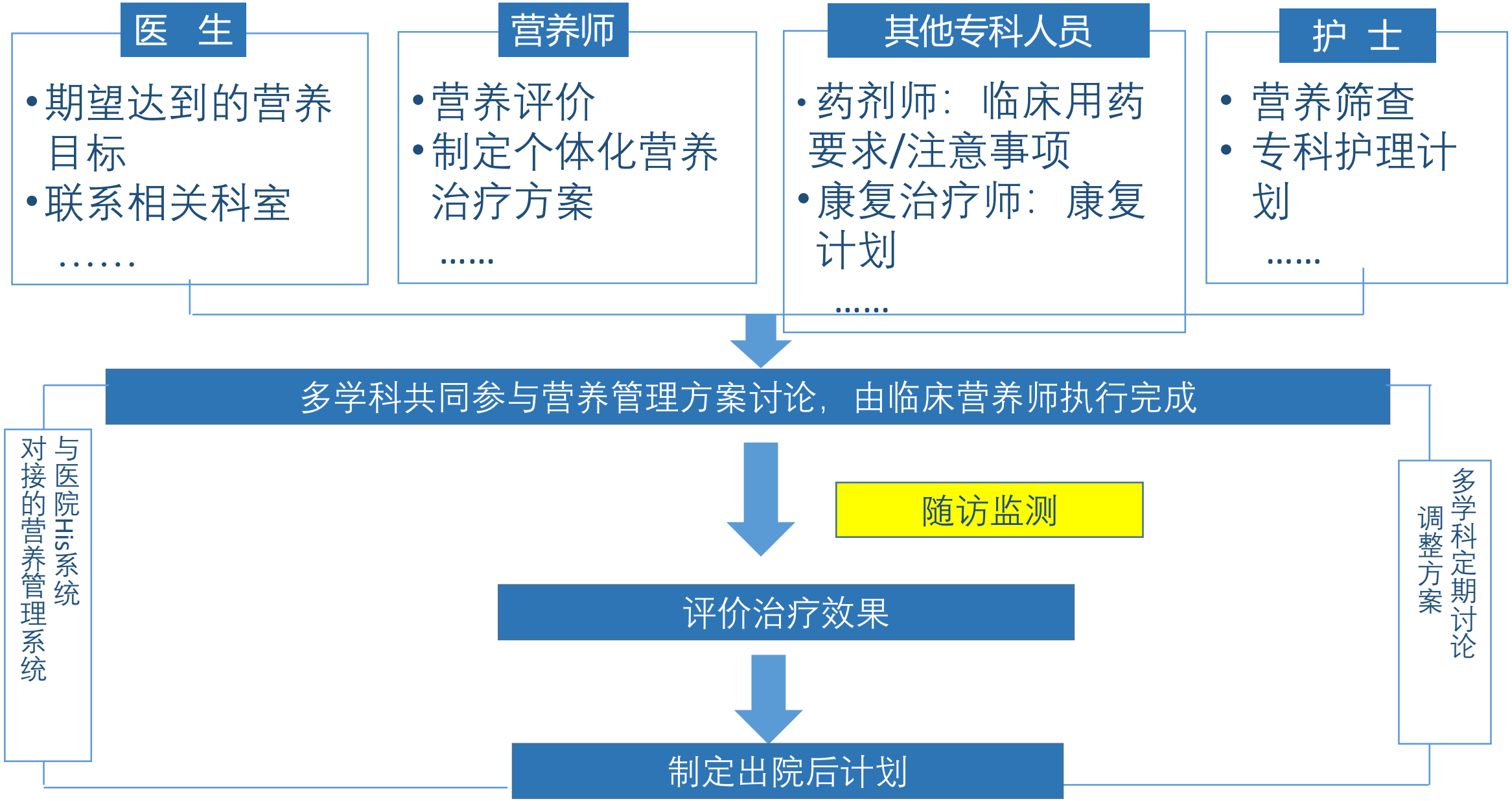


Rinninella E, et al. Nutrition. 2018 Feb 5;50:74-81.

我们的进一步工作


胰腺、胆管或壶腹占位病人
门诊：ERAS 评估、调整营养、宣教
拟行胰十二指肠切除术
入院：ERAS 多学科评估、治疗合并症、宣教
签署 ERAS 知情同意
ERAS 手术
EARS 术后
ERAS 随访
入组标准：
◆ 胰腺胃肠道重建手术方式为胰肠吻合者；
◆ 未联合血管切除（门静脉、腹腔干）者；
◆ 术后 72 小时无出血，无胆漏或乳糜漏者。
外科
麻醉科
肠外肠内营养科
手术室护理
病房护理团队
ICU
A 组
ERAS 干预组
查病历进行配对
B 组
回顾性队列

家庭营养支持管理模式


医　生
•期望达到的营养目标
•联系相关科室
……
营养师
•营养评价
•制定个体化营养治疗方案
……
其他专科人员
•药剂师：临床用药要求/注意事项
•康复治疗师：康复计划
……
护　士
• 营养筛查
• 专科护理计划
……
多学科共同参与营养管理方案讨论，由临床营养师执行完成
与医院Tis系统对接的营养管理系统
随访监测
多学科定期讨论调整方案
评价治疗效果
制定出院后计划

整体全程营养管理促进ERAS的良好结局

谢谢关注！