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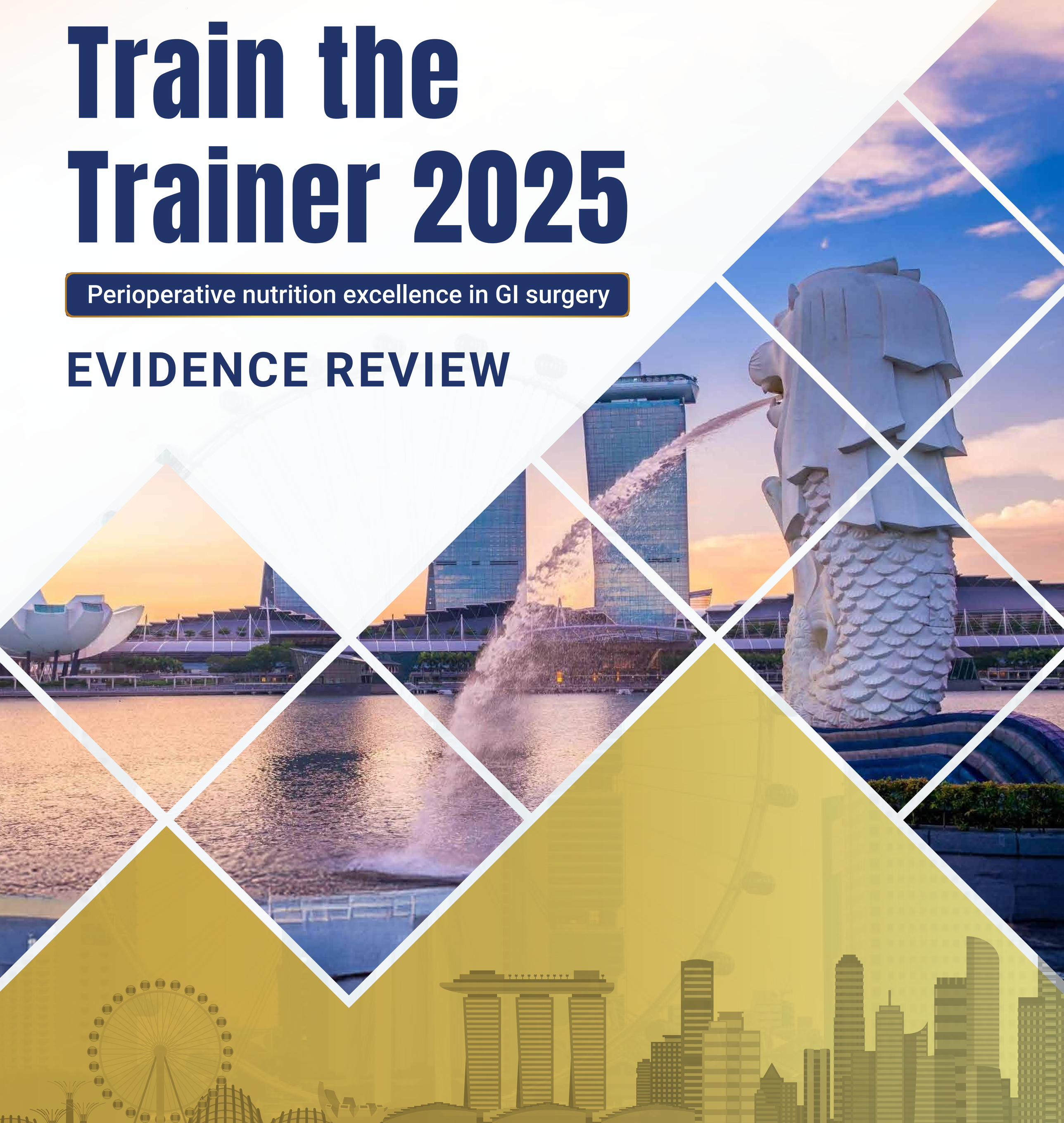
Road to Recovery

Enhanced by nutrition

Train the Trainer 2025

Perioperative nutrition excellence in GI surgery

EVIDENCE REVIEW



Preface

Surgery triggers a cascade of physiological responses collectively known as the surgical stress response. This response can lead to poor outcomes such as slower recovery and increased risk of complications. Optimizing nutritional strategies before, during and after surgery can improve patients' resilience and enhance recovery. The **Road to Recovery: Train the Trainer** program equips selected GI surgeons with the knowledge and insights to become champions of perioperative nutrition, and to train others in evidence-based enhanced recovery strategies. This booklet serves as a quick, evidence-based pre-read for participants, covering key principles and practical recommendations to build a solid foundation ahead of the program.

Surgery stresses the body[1,2]

Surgery induces metabolic and immune responses that shift the body toward a catabolic state.[1]

Neuroendocrine–metabolic axis: Includes Hypothalamic-Pituitary-Adrenal (HPA) axis and sympathetic nervous system → ↑cortisol, ↑ catecholamines, insulin resistance[2]

Inflammatory–immune axis: Cytokine release →Acute phase reaction, immune changes[2]

Systemic effects: Hypercatabolism, muscle breakdown, impaired immunity, delayed healing[2]

Clinical outcomes: Complications, risk of organ dysfunction, longer recovery[2]

Poor nutrition increases the vulnerability[3,4]

Gut surgery patients are malnourished

Pre-surgical sarcopenia aggravates the following:

1. Skeletal muscle wasting
2. Respiratory impairment
3. Fatigue
4. Increased risk of malnutrition
5. Decreased muscle protein synthesis

Result

3x higher risk of complications in malnourished patients

6x risk of complications

10x risk of infections

While nutrition screening is widely reported, only a few use a standard protocol, and only 35% of doctors actively manage nutrition themselves[5]

Nutritional deficiencies and GI surgeries[6]

A significant association between nutritional status and both early and late surgical complications has been observed.

An observational study examined the impact of malnutrition on surgical outcomes. Of the patients studied, 74% had undergone gastrointestinal surgeries.

The common surgeries included oncology-related surgeries, intestinal emicolectomy, occlusion, colostomy, acute appendicitis, appendicectomy, partial gastrectomy, and gastro-jejunal anastomosis.

Outcome	Well-nourished	At risk of malnourishment	Malnourished
Complications	31%	65.5%	3.5%
Complications on 6th post-operative day	26.7%	50%	23.3%

Nutrition interventions, when combined with the standard of care, can improve outcomes.

Place of nutrition in road to recovery: The fundamentals[7]

Nutrition is an integral part of Enhanced Recovery After Surgery (ERAS®) protocols.

Nutrition is part of a broader metabolic strategy that minimizes perioperative stress and improves surgical outcomes.

ERAS® uses multiple evidence-based interventions to reduce perioperative stress and maintain metabolic balance.

It applies an integrated, multimodal approach with synergistic, coordinated elements.

The protocol covers the entire patient journey: preadmission, preoperative, intraoperative, and postoperative stages.

Roadmap to enhanced recovery[8]

Nutrition plays a vital role in enhancing recovery at all stages of the perioperative period.

Preadmission

- Counseling
- Medical optimization
- Nutritional screening and appropriate intervention
- Smoking cessation
- Prehabilitation
- Anemia correction

Preoperative

- Modern fasting guidelines
- Carbohydrate loading
- Selective mechanical bowel preparation
- Antibiotic & skin preparation
- Thromboprophylaxis
- Selective premedication

Intraoperative

- Minimally invasive surgery
- Fluid balance management
- Active warming
- Locoregional anesthesia
- Postoperative nausea & vomiting prophylaxis
- Selective drain

Postoperative

- No nasogastric tube & early oral feeding
- Early mobilization
- Multimodal & opioid- sparing analgesia
- Avoidance of fluid overload
- Early removal of catheters and drains

6 fundamental aspects of nutrition in road to recovery[8]

1. Preoperative and postoperative nutrition screening is essential
2. Protein is as important as calories
3. Stop feeding late preoperatively; restart early postoperatively
4. Consider oral nutrition supplements for all patients
5. Follow the hierarchy: oral before enteral, enteral before parenteral
6. Nutrition management is a team effort

Advantages of nutrition in enhancing recovery[8,9]

- Improves resilience to withstand stress
- Supports in faster recovery and reduces complications
- Restores peripheral muscle protein mass
- Provides necessary energy for healing and recovery
- Helps the body cope with surgical trauma

Benefits of implementing ERAS®[10]

Comparison of outcomes between ERAS and control group

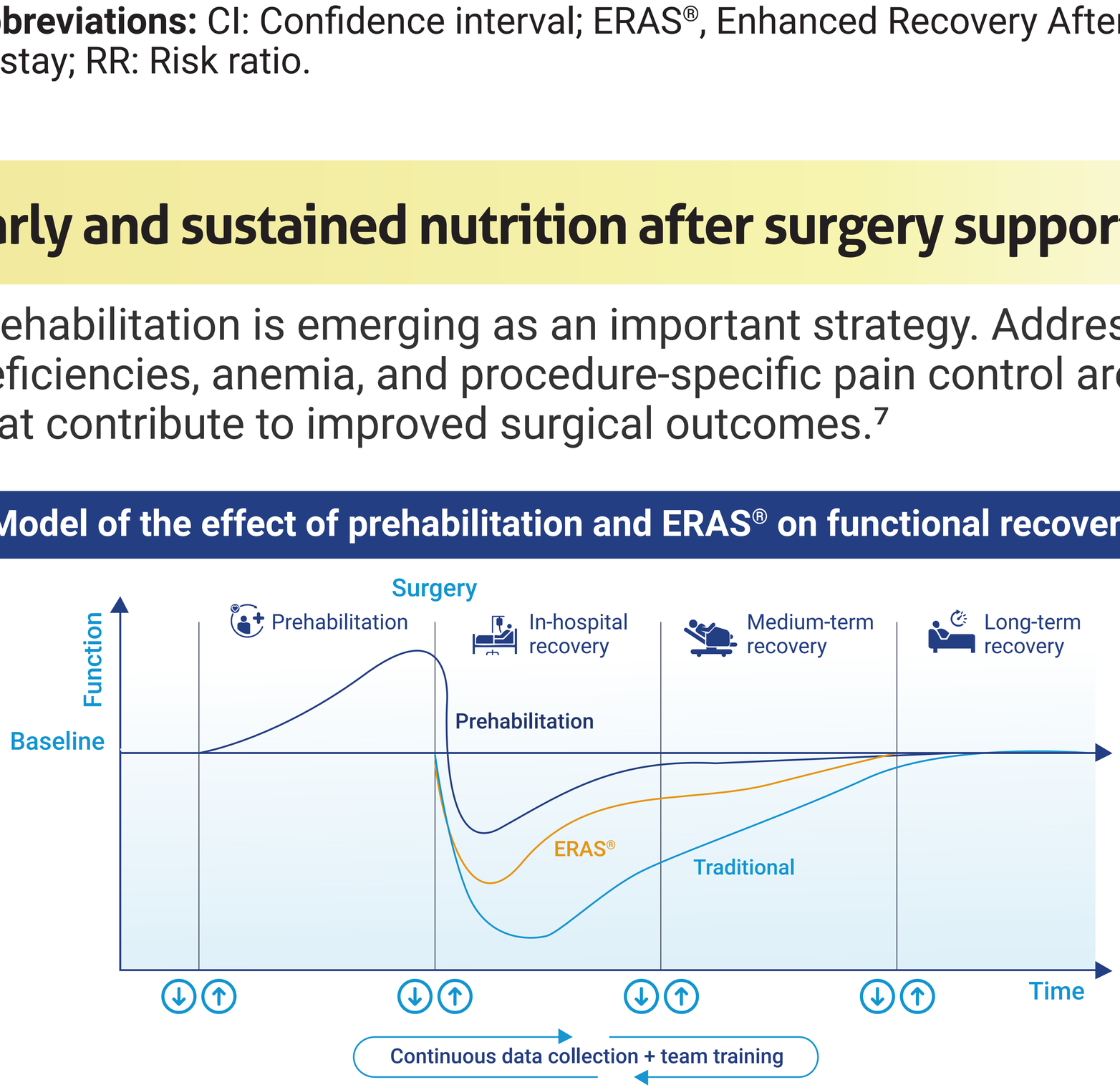
Improvements	ERAS (n=42)	Control (n=42)	RR (95% CI)	*P*
LOS, days	6 (5–7)	13 (11–19)	3.4 (95% CI, 0.1–2.6)	<0.001
Readmission	2 (5%)	4 (10%)	0.5 (95% CI, 0.1–2.6)	0.7
Complication	4 (10%)	9 (21%)	0.4 (95% CI, 0.1–1.3)	0.1

Abbreviations: CI: Confidence interval; ERAS®, Enhanced Recovery After Surgery; LOS: Length of stay; RR: Risk ratio.

Early and sustained nutrition after surgery supports better recovery

Prehabilitation is emerging as an important strategy. Addressing nutritional deficiencies, anemia, and procedure-specific pain control are key components that contribute to improved surgical outcomes.[7]

Model of the effect of prehabilitation and ERAS® on functional recovery



Starting early, including prehabilitation, can significantly improve functional outcomes.[7]

Adapted from: Dean HF, Carter F, Francis NK. Modern perioperative medicine–past, present, and future. Innov Surg Sci. 2019 Dec 5;4(4):123-31.

Nutrition: From pre-admission to post-discharge

Phase[1]	Definition	Time frame	Example measures
Preoperative	Preparation for postoperative recovery	Weeks to months	Adequate functional capacity to withstand surgical stress, resolution of malnutrition, sense of control and self-efficacy, prophylactic measures provided such as antibiotics and carbohydrate loading
Intraoperative	During the course of the surgical procedure	Hours	Fluid balance, pain and anaesthesia management
Postoperative Early Intermediate Late	Until discharge from PACU Until discharge from hospital Until illness no longer disrupts daily life	Hours Days Weeks to month	Vital signs Bowel recovery, length of hospital stay Patient-reported resolution of symptoms, return to pre-surgery activities and functional capacity

PACU: Post-anesthesia care unit

ESPEN 2025: Nutritional recommendations in road to recovery

Nutrition in prehabilitation[9]

Recommendation/Practice	Details
Prehabilitation is offered on a risk-stratified basis.	Multimodal prehabilitation—including exercise, nutrition, psychological support, and respiratory therapy—is recommended for selected high-risk patients.
Nutritional, physical and psychological aspects to be assessed.	Supervised/specialist-led prehabilitation is advised for patients with severe malnutrition/ older adults; universal prehabilitation may be suitable for low-risk patients.

Preoperative nutrition[9]

Recommendation/Practice	Details
Routine nutritional status assessment is essential for patients undergoing major surgery.	Assessment guides perioperative nutrition therapy.
Body composition assessment for surgical cancer patients.	CT scan preferred, alternatives: BIA/ anthropometry, SARC-F screening.
Frailty assessment is crucial for older patients undergoing major surgery.	Frailty, not chronological age, is key for risk stratification.
Start nutrition if oral intake is <50% for >7 days, or if oral intake is expected to be inadequate for ≥5 days perioperatively.	Early initiation is especially important for malnourished patients.
Prefer oral/enteral tube feeding over PN whenever feasible.	Oral or tube route should be prioritized at all stages.
For patients with severe malnutrition or high metabolic risk, initiate preoperative nutrition for 10–14 days, even if it delays surgery.	Criteria: ≥10–15% weight loss/6 months, BMI<18.5, NRS ≥ 5 / SGA C, albumin < 30 g/L.
ONS is recommended for all patients who are not meeting nutritional intake through food, regardless of their nutritional status.	Encourage ONS during the preoperative period; address compliance issues through patient education.
ONS in malnourished/high-risk patients matched to individual deficits.	Target calories, protein, micronutrients in the preoperative periods, ensuring full nutritional composition.
Preoperative immunonutrition (arginine, omega-3 fatty acids,, nucleotides) for 5–7 days is recommended in GI cancer patients.	Lowers infectious complications and shorten hospital LOS.
Use EN (pre-hospital/at home) if indicated.	With homecare support when necessary.
Preoperative PN should be considered for 10–14 days only if ONS/EN are not feasible in severely malnourished or high-risk patients.	Minimum duration of 7 days is recommended, with EN preferred over PN whenever possible.

Intraoperative nutrition[9]

Recommendation/Practice	Details
Consider intraoperative NJ/feeding jejunostomy placement (malnutrition/ high-risk): Esophagectomy, gastrectomy, pancreaticoduodenectomy.	Reduces the risk of postoperative nutrition deprivation and complications.

Preoperative nutrition[9]

Recommendation/Practice	Details
Start early EN within 24 hours if oral intake is inadequate or not possible.	Especially important for patients with with expected <50% intake for 7 days, malnutrition, head/neck/UGI tumors, severe trauma/TBI.
Use a fully balanced standard polymeric formula for EN.	Oligopeptide/fiber-enriched only if specifically indicated; avoid home-made feeds.
Adapt oral diet based on individual tolerance/surgical procedure.	Carefully assess patients at risk for delayed gastric emptying/ileus.
Monitor and prevent refeeding syndrome in malnourished/ metabolically at-risk patients.	Start EN slowly (10–30 mL/h) and titrate as tolerated and as electrolytes stabilize.
For prolonged tube feeding (>4 weeks), consider PEG/PEJ placement.	Particularly relevant for patients with TBI, neurosurgical, or stenosis patients.
Immunonutrition for major tumor surgery (peri or preoperative).	Formulations containing arginine, omega-3 fatty acids, and nucleotides reduce complications and shorten hospital length of stay (LOS).
If energy needs are not met by oral/EN within 3–4 days, supplement with PN.	Supplement with PN to achieve >50% of nutrition requirements.
Start PN promptly if EN/oral is contraindicated(e.g., obstruction) in severely malnourished patients.	Early initiation is critical in this scenario.
Prefer all-in-one PN bags if PN needed.	Three-chamber/composite bags reduce infection and errors.

Nutrition in post-discharge[9]

Recommendation/Practice	Details
Continue nutrition assessment post-discharge in perioperative patients.	Continue ONS/tube feeding as indicated, coupled with regular dietetic follow-up/support.
Intraoperative-placed jejunostomy may be retained at discharge if needed.	Based on weight trends, chemo tolerance.
HEN or ONS after upper GI surgery (particularly gastrectomy/ oesophagectomy).	Reduces weight/muscle loss, improves chemo completion.

Abbreviations:
BIA: Bioelectrical Impedance Analysis; BMI: Body mass index; CT: Computed tomography; ONS: Oral nutritional supplements; EN: Enteral nutrition; ESPEN: European Society for Clinical Nutrition and Metabolism; HEN: Home enteral nutrition; LOS: Length of stay; NJ: Nasojejunal, NRS: Nutritional risk screening; PEG: Percutaneous endoscopic gastrotomy; PEJ: Percutaneous endoscopic jejunostomy; PN: Parenteral nutrition; SARC-F: Strength, Assistance in walking, Rise from a chair, Climb stairs, and Falls; SGA: Subjective global assessment; TBI: Traumatic brain injury; UGI: Upper gastrointestinal.

Nutrition in enhancing recovery: A glance at evidence[10-15]

Study	Methodology	Intervention	Observations
Kannan V, *et al.* 2025[10]	Systematic review of the performance of ERAS® protocols *vs.* conventional care in colorectal surgery	ERAS® protocols *vs.* conventional care in colorectal surgery	Notable reduction in hospital stay (by 3-8 days), faster GI recovery, quicker bowel movement, defecation, and resumption of normal diet, reduced postoperative complications, reduced opioid dependence, elevated albumin and total protein levels, and reduced inflammatory markers *vs.* conventional care.
Lohsiriwat V, *et al.* 20218[11]	Comparison of 5-year OS after non-metastatic CRC surgery between ERAS® *vs.*CC, and assess the link between ERAS® compliance and OS	ERAS® (n = 70) *vs.* conventional care (n = 279)	ERAS® significantly improved 5-year OS after non-metastatic CRC surgery, especially in stage III. High compliance yielded better OS than low compliance. OS: 80.3% in ERAS® and 65.6% in CC (HR 0.54, 95% CI: 0.33–0.88, p = 0.014).
Mihăilescu A, *et al.* 2024[12]	Clinical significance of the ERAS® program *vs.* comparison with conventional postoperative care in patients undergoing CRC surgery	ERAS® (n = 40) *vs.* conventional care (n = 80)	Patients in the ERAS® group had a significantly shorter median hospitalization *vs.* non-ERAS® group (p = 0.0002). ERAS® patients also had notably fewer stomas.
Samuel KA, *et al.* 2025[13]	ERAS® effectiveness in colorectal surgery for reducing hospital stay through early oral feeding and mobilization	ERAS® (n=50) *vs.* control group (n=50)	Early mobilization with ERAS® (mean of 1.2 ± 0.5 days); reduction in the length of hospital stay in the ERAS® group (5–8 days), when compared to the control group (10–11 days).
Zhou X, *et al.* 2022[14]	Safety and efficacy of ERAS® program in laparoscopic hepatectomy	Enhanced recovery care (n=274) *vs.* traditional care (n= 369)	ERAS® was associated with decreased hospital stay [SMD = −0.56, 95% CI: −0.83~−0.28, p<0.0001], shorter duration to functional recovery (SMD = −1.14, 95% CI: −1.92−0.37, p = 0.004), and lower cost of hospitalization MD = −1,539.62, 95% CI: −1992.85~−1086.39, p<0.00001). Lower overall postoperative complication rate in ERAS® group [RR=0.64, 95% CI: 0.51~0.80, p<0.0001] as well as lower Grade II–V complication rate (RR=0.55, 95% CI: 0.38~0.80, p=0.002).
Dipasquale V, *et al.* 2022[15]	Outcomes of an ERAS® protocol in pediatric IBD surgery	ERAS® (n=21) and non-ERAS® (n=40)	The postoperative complication rate was significantly lower in the ERAS® group *vs.* non-ERAS® group (29.6% *vs.* 55%, p=0.049). The first defecation occurred earlier in the ERAS® group than in the non-ERAS® group (p<0.001).

Abbreviations:
CC: Cervical cancer; CI: Confidence interval; CRC: Colorectal cancer; ERAS®, Enhanced Recovery After Surgery; GI: Gastrointestinal; IBD: Inflammatory bowel disease; MD: Mean deviation; OS: Overall survival; RR: Relative risk; SMD: Standard mean deviation.

Conclusion

Surgical injury creates physiological stress and leads to metabolic changes

Poor nutrition is associated with poor patient outcomes

Perioperative nutrition – Early to postoperative nutritional interventions are significant to ensure enhanced recovery

Nutrition helps minimize surgical stress and supports faster recovery

You are the catalysts on the road to recovery

The participants of this program are not just learners- they are the catalysts for change within their hospitals/institutions.

Equipped with the knowledge and skills to master the principles of perioperative nutrition and enhanced recovery, they are empowered to guide peers and teams in integrating evidence-based strategies that improve patient outcomes.

This *Road to Recovery* journey extends beyond the hospital, and through their role as trainers, participants help ensure that best practices in nutrition and recovery reach every patient who can benefit.

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