# Nutrition in surgery

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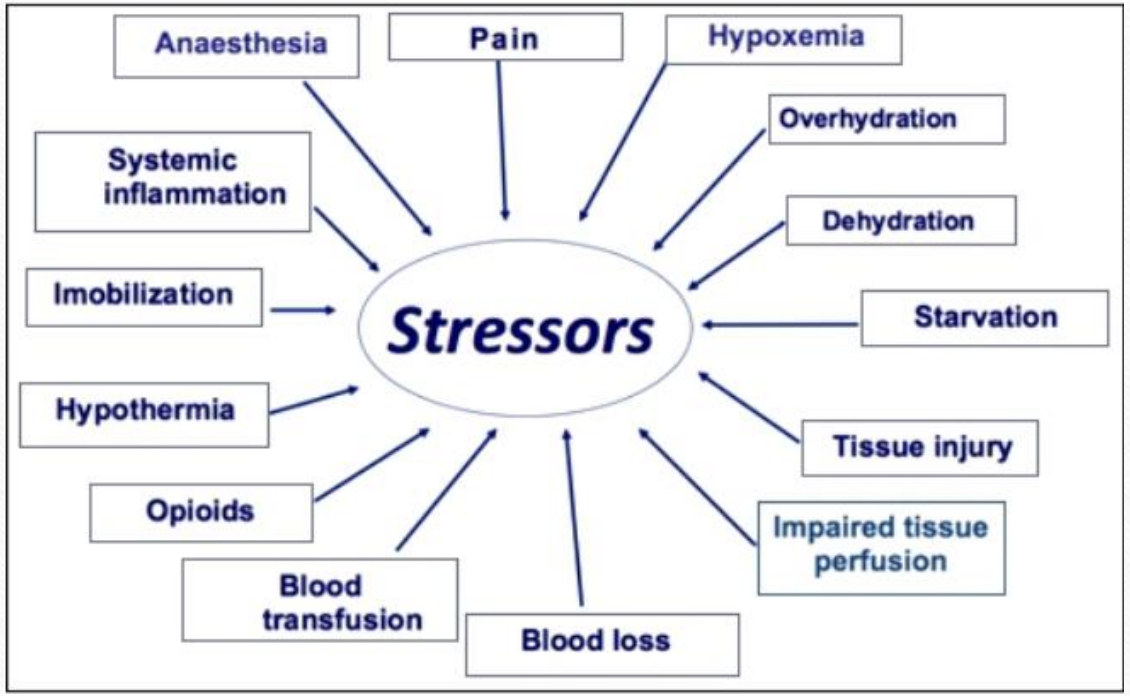
# Factors distract the patient return to normal functions

- Postoperative ileus,
- Distension of the abdomen,
- Pain from the wound,
- Nausea and Immobility comes from unnecessary use of tubes and drains
- Overuse of intravenous fluids.

# What are the stressors in patients under surgery?



# The Metabolic Response to Injury

- Release of stress hormones and cytokines
- Loss of the normal anabolic actions of insulin
- Development of insulin resistance
- Continuous breakdown of muscle tissue and loss of energy stores prolongs the time to recovery.

# Insulin resistance in surgery

- Release of the stress hormones (glucagon, catecholamines, cortisol and growth hormone) and the inflammatory reactions mediated by cytokines.
- Release of amino acids, free fatty acids and glucose to the blood stream in response to stress.
- Consume fat more than glucose.

# Complications after Surgery By Insulin resistance

- Hyperglycemia , Elevated HbA1
- Peak glucose level are associated with: infections, cardiovascular and renal problems, but also reoperations and even mortality .

# The Main Mechanism

- Increase in glucose production, reduction in glucose uptake, loss of activation of glucose transporters and glycogen storage.
- Glucose uptake is increased in the organs and cells, including blood cells, renal cells, endothelial cells and neural cells.
- Cells have no immediate mechanism to block glucose uptake in response to this rapidly developing stress and have no storage capacity for glucose except glycolysis.
- Glucose inflow to the mitochondria, the oxidative capacity is overwhelmed, oxygen free radicals are produced
- Cardiovascular complications, renal failure, neuropathy and infection will happened.

# Treating Insulin Resistance

- Controlling glucose levels and reducing protein breakdown  with insulin
- Peak glucose level and negative protein balance is related to the complication.

# The Patient with Diabetes

- Diabetic patients more often reach higher glucose levels after surgery than non-diabetics.
- The glucose level rose higher and stayed elevated longer than in the healthy controls,
- They prepare for surgery if concurrently given their usual morning medication .

# The Patient with Cancer

- Cancer is known to cause insulin resistance.
- Operation can be done within a few weeks.
- Ensure the patient is in the best metabolic and nutritional status by the time of the operation.

# Preoperative Fasting

- Carbohydrate load:  is associated with the effect on insulin action and insulin sensitivity
- The normal diurnal rhythm of metabolism are: Daytime metabolism and night-time metabolism
- Insulin is a key regulator of both.
- The effects of insulin remain for 4-5 hours, and are usually still active by the time the next meal is consumed.
- After this time: anti-insulinergic and catabolic like glucagon and cortisol increased.
- This is the situation comes into surgery if in an overnight fasted state.

# Carbohydrate loading

- 20% glucose infusion intravenously overnight at a rate of 5 mg/kg/min or
- Intake of 200-400 ml of a carbohydrate rich drink at a concentration of around 12%
- The carbohydrate load has effects mainly on the peripheral uptake of glucose in the first day or two , while later the effect of a carbohydrate load is mainly to reduce endogenous glucose production .
- Both these effects will lower glucose levels in the postoperative phase .

# Post operative effect of carbohydrate loading

- Attenuated postoperative insulin sensitivity by ;
- limiting muscle inflammation , improving insulin's ability to inhibit pyruvate dehydrogenase kinase-4 activity .
- Protein metabolism is better maintained , lean body mass is retained and postoperative muscle function and also heart functions is better.

# Pain Control under surgery

- Epidural anesthesia by blocking at the level of T8-9, before the onset of surgery, avoid the release of catabolic hormones.
- Pain itself causes insulin resistance.
- Avoiding pain: is a key feature during the postoperative phase, and the epidural plays a key role.

# Multimodal Metabolic Approach

- Epidural anesthesia and analgesia plus carbohydrate loading: reduce insulin resistance
- This combination allowed:
- Complete enteral feeding immediately
- Glucose levels were kept within the normal range (110 mg/dL)

# Enhanced Recovery After Surgery (ERAS) protocol

- Multidisciplinary team approach with a focus on:
- Stress reduction and promotion of return to function,
- Allow patients to recover more quickly from major surgery,
- Decline in nutritional status and fatigue,
- Reduce the risk of complications,
- Reduce health care costs and hospital stay.

# ERAS: the Core Concept

- The four domains thought to be critical for recovery are:
- Pain control
- Gut function
- Mobilization
- and to avoid complications.

# ERAS…

- Pain control aims to keep the patient pain free throughout the recovery, initially with the use of thoracic epidurals if open surgery, regional blocks or IV lidocaine, and later on with oral analgesics.
- Gut function will be supported by avoiding opioids and nausea, and by maintaining neutral fluid balance to allow intake of fluids and normal food and the return of bowel movements as soon as possible.
- Also, patients should be mobilized as quickly as possible aiming to return to normal preoperative levels as soon as possible

# The Multidisciplinary Team

- Nurses, anesthetists and surgeons and help from dieticians, physiotherapists and occupational therapists are needed.

- A useful tool in implementing ERAS is the use of audit of a combination of outcomes and care processes.

# Elements of the ERAS Protocol

- A novel development: the pre habilitation programs
- Light physical training(anaerobic and aerobic) plus nutritional management with protein intake and mental preparation.
- It improve physical function especially in older and frail patients .

# ERAS..

- Laparoscopic surgery
- Step-down analgesia is usually oral paracetamol and non-steroidal anti-inflammatory drugs.
- Careful management of the transition between epidural and oral analgesia is key to minimizing the exposure of patients to systemic opioids.

# ERAS…

- Early postoperative feeding, even in the presence of an intestinal anastomosis.
- Combination with preoperative carbohydrate loading and epidural analgesia , early enteral feeding has been shown to allow the maintenance of nitrogen equilibrium.
- Routine intraoperative and postoperative antiemetics and reduced exposure to systemic opiates are important .

# ERAS..

- Peritoneal drains are avoided as they inhibit mobilization and their use does not reduce the incidence or severity of anastomotic leaks.
- Similarly urinary catheters are removed early; this may be possible within 24 hours of surgery.
- Antibiotic prophylaxis, thromboprophylaxis, avoidance of routine nasogastric tubes and avoidance of perioperative hypothermia are employed within the ERAS protocol.

# Nutritional Therapy in the Perioperative Period

- Undernutrition: (WHO) :body mass index (BMI) < 18.5kg/$m^2$.
- Malnutrition(GLIM): phenotypical (non-volitional weight loss, low BMI, reduced muscle mass) and etiological criteria (reduced food intake or assimilation, inflammation or disease burden).

# Malnutrition Definition

- Malnutrition (ESPEN) :
  -option 1: BMI < 18.5kg/m
  -option 2: combined: weight loss >10% or >5% over 3 months and reduced BMI or a low fat free mass index (FFMI).
  Reduced BMI < 20 or < 22 $kg/m^2$ in patients younger and older than 70 years. Low FFMI is < 15 and < $17kg/m^2$ in females and males, respectively.

# Nutritional screening

**Nutritional aspects in the surgical patient**

- Nutritional Risk Screening on admission or first contact

- Observation and documentation of oral intake

- Regular follow-up of weight and BMI

# Evaluating Metabolic Risk

- Nutritional Risk Score :
- The prescreening which takes only a few minutes includes the following items:
- - BMI < 20.5 kg/m2
- - weight loss within 3 months
- - diminished food intake
- - severity of the disease

- A severe metabolic risk :
- must be considered in the presence of one or more of the following criteria:
- - weight loss > 10-15 %
- - BMI < 18.5kg/m2
- - NRS >5, SGA C
- - Serum albumin < 30g/l (no hepatic or renal disease)

# Indications for Nutritional Support

- Avoidance of long periods of pre-operative starving and re-establishment of oral feeding as early as possible after surgery.
- Oral nutrition can be initiated a few hours after surgery .
- If tolerance to oral fluid and food intake is limited for more than 4 days, it is recommended that peripheral parenteral hypocaloric nutrition is started (e.g. two-chamber bag with glucose 8-10% and amino acids 10%).

# Starting Nutritional Support

- Nutritional support should be initiated if it is anticipated that the patient will be unable to eat for more than 5 days perioperatively. It is also indicated in patients who cannot maintain oral intake above 50% of recommended intake for more than 7 days.
- Combination with parenteral nutrition should be considered in patients in whom there is an indication for nutritional support and in whom nutritional needs cannot be met (e.g. < 50% of caloric requirement) via the oral/enteral route, e.g. in upper GI fistulae.
- Whenever possible the enteral route should be preferred.
- Parenteral nutrition: in undernourished patients in whom enteral nutrition is not feasible or not tolerated, in patients with postoperative complications impairing gastrointestinal function who are unable to receive and absorb adequate amounts of oral / enteral feeding for 7 days or more .

# Immunological Preconditioning

- Immunonutrition: use of formulae enriched with arginine, glutamine, omega-3-fatty acids and nucleotides.
- Patients with severe nutritional risk may benefit from these formula. Those;
  - Undergoing major cancer surgery of the neck (laryngectomy, pharyngectomy) and of the abdomen (oesophagectomy, gastrectomy, and pancreatoduodenectomy) as well as those who have experienced severe trauma.
- It decreased rate of postoperative infections and length of stay in hospital.

# Postoperative Nutrition

- Early oral and/or enteral food intake: diminishes the risk of infectious complications, shorter length of hospital stay, no increase in the risk of developing anastomotic leakage after gastrointestinal tract surgery.
- Drink clear fluids with enteral nutrition delivered via a tube whose tip is placed distal to the anastomosis is practical.
- Supplementary postoperative tube feeding by naso-jejunal tube or fine needle catheter jejunostomy (NCJ) placement at the time of surgery for those;
- After major surgery for cancer of the abdomen and head and neck - laryngectomy, pharyngectomy, esophageal resection, gastrectomy, partial pancreato-duodenectomy – and severe trauma.

# Postoperative Nutrition

- Enteral tube feeding can be started with low amounts (5-10ml/h) within 24 hr after surgery.
- The administration rate should be cautiously increased stepwise (for example by 10-20ml/h per day).
- Gastrointestinal tolerance must be monitored carefully (e.g. gastric residual volume, abdominal distension, peristalsis)

# Indications for Parenteral Nutrition (PN)

- Undernourished patients in whom enteral nutrition is not feasible or not tolerated,
- Patients with postoperative complications impairing gastrointestinal function who are unable to receive and absorb adequate amounts of oral/enteral feeding for at least five days.
- Combined enteral and parenteral feeding should be considered in all patients in whom there is an indication for nutritional support and in whom >50% of nutritional needs cannot be met via the enteral route (high output enterocutaneous fistulae or short bowel syndrome).
- The main contraindications to enteral nutrition are
- Bowel obstruction or ileus
- Severe shock with hemodynamic instability
- Lack of integrity of the proximal GI tract ( anastomotic breakdown)

# Kind of parenteral nutrition

- Standardization may follow a protocol, and "All-In-One" mixtures (AIO) (two-chamber-bag with glucose and amino acids, three chamber bag with glucose, amino acids and lipids) may be used.
- The advantages of AIO mixtures have been shown with regard to feasibility, time and cost saving, and the lower risks of contamination.

# Amino Acids

- For the catabolic patient with proteolysis and loss of body cell mass the supply of amino acids is essential.
- protein synthesis is an energy consuming process. amino acids and glucose (and lipids)  should be supplied at the same time.
- 1.5-2 g/kg of ideal body weight (IBW) (about 20 % of total energy requirement) .
- Intravenous glutamine (0.35-0.4g/kg BW/d) In the TPN or near total
- No data are yet available

# Glucose

- "Intensified insulin therapy" has increased metabolic awareness regarding hyperglycemia.
- At present, the optimal serum glucose level appears to be about 140 - 150 mg% (7.7-8.3mmol/l) .

# Lipids

- For a long time there were major concerns about administering lipids earlier than 10 days after the start of PN by soy emulsion .
- Omega-9 rich olive-oil based lipids, are well tolerated in critically ill patients .
- A ratio of omega-6 to omega-3 of 3:1 is considered to be immune neutral .
- Supplementation of PN with omega-3 fatty acids may decrease mortality in critically ill patients with abdominal sepsis .

# Ratio of Macronutrients

- The protein:fat:glucose ratio should approximate to 20:30:50.
- Increase the glucose: fat ratio from 50:50 to 60:40 or even 70:30% of the non-protein calories;
- Due to the problems encountered regarding hyperlipidemia and fatty liver .

# Caloric Amount

- In the acute phase: should not exceed 25kcal/kg of IBW.
- The recommended rates of supply are
- Glucose 3-4g/kg IBW , lipids 0.7-1,5g/kg IBW and amino acids 1-1.5-2g/kg/IBW.

- In the phase of recovery : calories should be 1.2 to 1.5 fold higher than the calculated energy requirement.
- Indirect calorimetry : will provide useful optimal energy supply .

# Vitamins and Trace Elements

- In well nourished patients who recover with oral or enteral nutrition by postoperative day 5 ,vitamins and trace elements is not required.
- Patients who are unable to be fed via the enteral route or in whom total or near total parenteral nutrition is required, a full range of vitamins and trace elements should be supplemented on a daily basis.
- New lipid emulsions containing alpha-tocopherol.

# Monitoring

- Typical short term problems of parenteral nutrition are:
- - Hyperglycemia
- - Hyperlipidemia
- - Reversible micro- and macro vesicular steatosis of the liver
- - Cholestasis

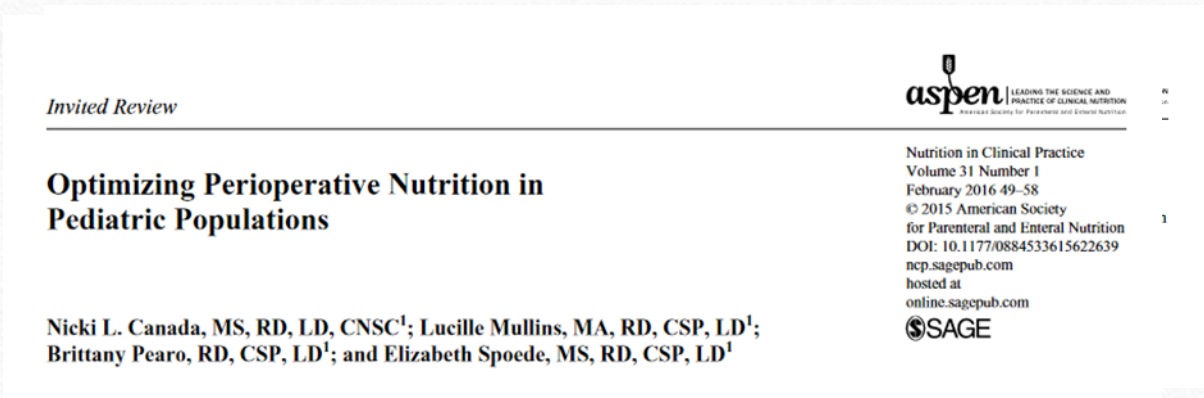
# Monitoring

**Blood chemistry**

- electrolytes including phosphate and magnesiums
- blood glucose
- triglycerides
- creatinine
- liver enzymes and bilirubin
- serum lactate and procalcitonin in the critically ill

# Follow up

- Weight and BMI are not sensitive enough because differences in body composition without change of BMI may occur.
- Bioelectrical Impedance Analysis (BIA) is a feasible noninvasive tool which is also convenient for outpatients .
- The fat free mass (FFM), the ratio of ECM/BCM and the phase angle may be easily calculated
- Ideally, the first measurement will be performed before surgery.



*Invited Review*

**Optimizing Perioperative Nutrition in Pediatric Populations**

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- Allowing patients to eat solids up to 6 hours before and clear liquids up to 2 hours before anesthesia.
- ERAS recommends providing an oral carbohydrate load and limit fasting to 3 hours in the peri-operative period.

# Estimating energy needs

- Postoperative pediatric patient: there may be an increased need for calories due to increased resting energy expenditure (REE), infection, and an inflammatory response to the surgery.
- To prevent overfeeding in infants :adequate calories to meet the REE until C-reactive protein level is <2 mg/dL.
- When available, indirect calorimetry should be used to determine energy needs.

- For children who are malnourished: Protein may be increased by 20%–25% if the wound is not healing as expected after a few days to a week after the child is consuming 100% of the initial estimated energy and protein needs.
- Confirmed deficiency of vitamin C or zinc :vitamin C deficiency, up to 5 times the Recommended Daily Allowance (RDA) for age may be given and divided into 2 daily doses.
- Zinc deficiency : twice the RDA of zinc for age may be given and divided into 2 daily doses.

# Glutamine and carnitine

- Glutamine is a conditionally essential amino acid, and its need becomes increased for the critically ill.
- Carnitine is a nonessential amino acid, decreased in prolonged use of PN and severe malnutrition.

# Nutritional Support

- Even if PN is needed to meet the nutrient needs of the patient, using trophic feedings at a rate of <10 mL/kg/d may improve tolerance and time to achieve full EN.
- If there is delayed gastric emptying due to ileus, consider jejunal feedings to provide nutrition into the distal small intestine.
- The targeted range of blood glucoses should be between 140 and 180 mg/dL.

# POI(post operative Ileus)

Definitions and sub-classification of postoperative ileus (2, 12)

| Definitions (2, 12) |
| --- |
| POI is a transient cessation of coordinated bowel motility after surgical intervention which prevents effective transit of intestinal contents or tolerance of oral intake. |
| Recurrent POI is the occurrence of ileus after an apparent resolution of the immediate postoperative POI. |
| A primary POI occurs in the absence of any precipitating cause, and a secondary POI occurs in the presence of a complication (e.g. sepsis, anastomotic leak). |
| Prolonged POI<br>• > 3 days for laparoscopic surgery<br>• > 5 days for open surgery |
| **Sub-classification (12)** |
| **Type Definition** |
| 1. Affects the entire gastrointestinal tract with nausea, vomiting, and a failure to pass flatus or stool. |
| 2. Affects the upper gastrointestinal tract with nausea and vomiting, but with the presence of colonic activity. |
| 3. Manifests as no passage of flatus and/or stool, but with tolerance of diet. |

# Risk factors for postoperative ileus

Risk factors for postoperative ileus

| Risk Factor | Possible Mechanisms |
|---|---|
| Increasing age (22, 24) | Reduced overall capacity for the body to recover from surgical insult (24) |
| Male gender (17) | Increased inflammatory response to surgery (19)<br>Increased pain threshold in males (16), resulting in higher catecholamine release (20) |
| Low preoperative albumin (24) | Increased oedema and stretch of gut |
| Acute and chronic opioid use (15, 22) | μ-opioid receptor stimulation ameliorates peristalsis (18, 23) |
| Previous abdominal surgery (22) | Increased need for adhesiolysis, increased bowel handling |
| Pre-existing airways/peripheral vascular disease (17) | Reduced physiological reserve |
| Long duration of surgery (15, 17) | Increased bowel handling (21) and opiate use |
| Emergency surgery (16, 19) | Increased inflammatory and catecholamine response; secondary causes of POI |
| Blood loss and need for transfusion (15, 17, 22, 24) | Increased crystalloid administration resulting in oedema |
| Procedures requiring stomas (19) | Oedema in abdominal wall muscle and cut bowel |

# Clinical Features and Diagnostic Criteria

- Abdominal pain, symmetrical abdominal distension, anorexia, nausea or vomiting, and failure to pass stool or flatus.
- Prolonged POI may necessitate parenteral nutrition.
- Causes of POI: peritonitis, pre-existing electrolyte disturbances, a prolonged operative duration, significant bowel handling and excessive blood loss.

# POI Management

**Principles for management of prolonged postoperative ileus**

Restoration of normal physiology
Insertion of NGT
Accurate measurement of fluid input and output
Exclusion and treatment of secondary causes
Nutritional team consultation (≥5-7 days)

# Postoperative ileus Prevention

**Strategies to prevent postoperative ileus**

| Intervention | Mechanism | Benefit |
|---|---|---|
| Avoidance of salt and fluid overload | ↓ gut oedema and stretch | ++ |
| Carbohydrate loading | ↓ insulin resistance | ± |
| Routine nasogastric tubes | Prophylactic drainage of stomach | - |
| Intravenous lidocaine | Anti-inflammatory; opioid-sparing | + |
| Coffee | Stimulatory effect | + |
| Chewing gum | Stimulatory effect | + |
| NSAIDs | Opioid sparing; anti-inflammatory | ++ |
| Early enteral nutrition | Anabolic; ↓ insulin resistance; stimulatory | ++ |
| ERPs | Multimodal-effect | ++ |
| Laparoscopic Surgery | ↓ tissue trauma; ↓ bowel handling; ↓ inflammatory reaction | ++ |
| Alvimopan | μ-opioid receptor antagonist | ++ |
| Mid-thoracic epidural anaesthesia | ↓ inflammatory response<br>↓ sympathetic stimulation<br>↓ opioid requirement | ++ |
| Early mobilisation | ? anabolic effect | +/± |
| Nicotine | Colonic prokinetic | + |
| Daikenchuto | Anti-inflammatory on acetylcholine receptors | + |
| Magnesium sulphate | Anaesthetic effect | + |
| Prokinetics | Prokinetic effect | ± |

- Thanks a lot….