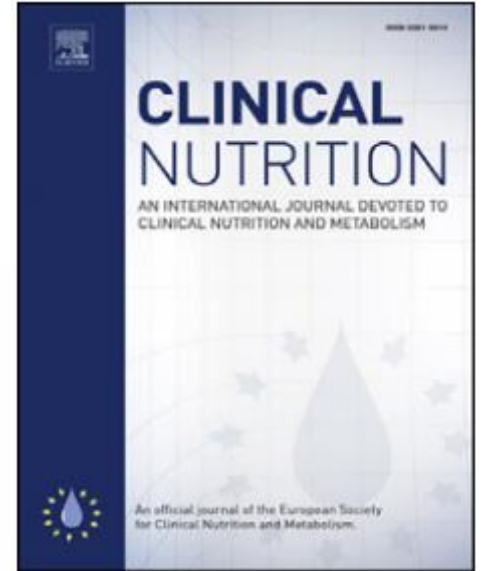


Guideline for clinical nutrition in ICU

ESPEN 2019



Clinical nutrition
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Point of interest


Who are the patients at risk?

How to assess nutritional status of an ICU patient?

How to define the amount of energy to provide?

The route to choose

How to adapt according to various clinical conditions?



“To achieve optimal nutritional support for ICU patients and to illuminate the gaps in knowledge in order to provide priorities for future clinical research”

The ultimate goal.....



“Nutritional intervention needs to be planned carefully and considered at the same level as any other therapy supporting organ functions in the ICU”

Levels of evidence [3].

1++	High quality meta-analyses, systematic reviews of RCTs, or RCTs with a very low risk of bias
1+	Well-conducted meta-analyses, systematic reviews, or RCTs with a low risk of bias
1-	Meta-analyses, systematic reviews, or RCTs with a high risk of bias
2++	High quality systematic reviews of case control or cohort studies. High quality case control or cohort studies with a very low risk of confounding or bias and a high probability that the relationship is causal
2+	Well-conducted case control or cohort studies with a low risk of confounding or bias and a moderate probability that the relationship is causal
2-	Case control or cohort studies with a high risk of confounding or bias and a significant risk that the relationship is not causal
3	Non-analytic studies, e.g. case reports, case series
4	Expert opinion

Grades and forms of recommendations (SIGN) [3].

a) Grades of recommendation

A	At least one meta-analysis, systematic review, or RCT rated as 1++, and directly applicable to the target population; or A body of evidence consisting principally of studies rated as 1+, directly applicable to the target population, and demonstrating overall consistency of results
B	A body of evidence including studies rated as 2++, directly applicable to the target population; or A body of evidence including studies rated as 2+, directly applicable to the target population and demonstrating overall consistency of results: or extrapolated evidence from studies rated as 1++ or 1+.
0	Evidence level 3 or 4; or extrapolated evidence from studies rated as 2++ or 2+
GPP	Good practice points. Recommended best practice based on the clinical experience of the guideline development group



Nutritional disorders and Nutritional related conditions

Malnutrition/
undernutrition

Sarcopenia/
frailty

Overweight/
obesity

Micronutrient
abnormality

Re-feeding
syndrome



Definition

- **Isocaloric diet** is an energy administration of around the defined target.
- **Hypocaloric or underfeeding** is an energy administration **below 70%** of the defined target.
- **Trophic feeding** is a minimal administration of nutrients having beneficial effects
- **Overfeeding** is energy administration of **110% above** the defined target.
- **Low protein diet** is protein administration below 0.5 g/kg/day.



Who should benefit from medical nutrition?

Who should be considered for medical nutrition therapy?

- **Medical nutrition therapy shall be considered **for all patients staying in the ICU**, mainly for more than 48 h**

Grade of Recommendation: Good practice point
Strong consensus (100% agreement)



How to assess malnutrition?

- **A general clinical assessment should be performed to assess malnutrition in the ICU, until a specific tool has been validated.**

Grade of Recommendation: Good practice point
Strong consensus (100% agreement)



How to screen for the risk of malnutrition during hospital stay?

- **Every critically ill patient staying for **more than 48 h in the ICU** should be considered at risk for malnutrition.**

Strong consensus (96% agreement)

Who are the patients at risk?

Table 5
Thresholds for severity grading of malnutrition into Stage 1 (Moderate) and Stage 2 (Severe) malnutrition according to the recent ESPEN GLIM recommendations [23].

	Phenotype criteria			Etiology criteria	
	Weight loss (%)	Body mass index (kg/m ²)	Muscle mass ^a	Food intake, malabsorption or GI symptoms	Disease burden/inflammation
Stage 1/Moderate Malnutrition (Requires 1 phenotypic and 1 etiologic criterion)	5–10% within the past 6 mo, or 10–20% beyond 6 mo	<20 if <70 yr, <22 if ≥70 yr Asia: <18.5 if <70 yr, <20 if ≥70 yr	Mild to moderate deficit (per validated assessment methods – see below)	Any reduction of intake below ER for >2 weeks, or moderate malabsorption/GI symptoms ^b	Acute disease/injury ^d , or chronic disease-related ^e
Stage 2/Severe Malnutrition (Requires 1 phenotypic and 1 etiologic criterion)	>10% within the past 6 mo, or >20% beyond 6 mo	<18.5 if <70 yr, <20 if ≥70 yr Asia: TBD	Severe deficit (per validated assessment methods – see below)	≤50% intake of ER for >1 week, or severe malabsorption/GI symptoms ^c	Acute disease/injury ^d , or chronic disease-related ^e

GI = gastro-intestinal, ER = energy requirements, yr = year, mo = month.

^a For example fat free mass index (FFMI, kg/m²) by dual-energy absorptiometry or corresponding standards using other body composition methods like bioelectrical impedance analysis (BIA), CT or MRI. When not available or by regional preference, physical exam or standard anthropometric measures like mid-arm muscle or calf circumferences may be used. Thresholds for reduced muscle mass need to be adapted to race (Asia). Functional assessments like hand-grip strength may be used as a supportive measure.

^b Gastrointestinal symptoms of moderate degree – dysphagia, nausea, vomiting, diarrhea, constipation or abdominal pain.

^c Gastrointestinal symptoms of severe degree – dysphagia, nausea, vomiting, diarrhea, constipation or abdominal pain.


^d Acute disease/injury-related with severe inflammation. For example major infection, burns, trauma or closed head injury.

^e Chronic disease-related with chronic or recurrent mild to moderate inflammation. For example malignant disease, chronic obstructive pulmonary disease, congestive heart failure, chronic renal disease or any disease with chronic or recurrent Inflammation. CRP may be used as a supportive laboratory measure.



Who are the patients at risk?


- A pragmatic approach should be considered for patients at risk such as
 - those staying in the ICU > two days
 - undergoing mechanical ventilation
 - Infected
 - underfed >5 daysand/or presenting with a severe chronic disease



When should nutrition therapy be initiated, and which route should be used?

- **Oral diet shall be preferred over EN or PN in critically ill patients who are able to eat.**


Grade of Recommendation: Good practice point
Strong consensus (100% agreement)



When should nutrition therapy be initiated, and which route should be used?

- **If oral intake is not possible, **early EN (within 48 h)** in critically ill adult patients should be performed/initiated rather than delaying EN**


Grade of Recommendation: B
Strong consensus (100% agreement)



When should nutrition therapy be initiated, and which route should be used?

- **If oral intake is not possible, **early EN (within 48 h)** shall be performed/initiated in critically ill adult patients rather than early PN**


Grade of Recommendation: A
Strong consensus (100% agreement)



When should nutrition therapy be initiated, and which route should be used?

- **In case of contraindications to oral and EN, PN should be implemented **within 3-7 days****


Grade of Recommendation: B
Strong consensus (89% agreement)



When should nutrition therapy be initiated, and which route should be used?

- **Early and progressive PN can be provided instead of no nutrition in case of contraindications for EN in severely malnourished patients.**


Grade of Recommendation: O
Strong consensus (95% agreement)



When should nutrition therapy be initiated, and which route should be used?

- **To avoid overfeeding, early full EN and PN shall not be used in critically ill patients but shall be prescribed within three to seven days.**


Grade of Recommendation: A
Strong consensus (100% agreement)



When should nutrition therapy be initiated, and which route should be used?

- **To avoid overfeeding, early full EN and PN shall not be used in critically ill patients but shall be prescribed within three to seven days.**


Grade of Recommendation: A
Strong consensus (100% agreement)



We endorse contraindications as defined in ESICM guidelines and suggest withholding EN in critically ill patients with




- Uncontrolled shock
- Uncontrolled hypoxemia and acidosis
- Uncontrolled UGIH
- Gastric aspirate > 500 ml/6 h
- Bowel ischemia
- Bowel obstruction
- Abdominal compartment syndrome
- High-output fistula without distal feeding access.



In adult critically ill patients, does intermittent EN have an advantage over continuously administered EN?

- **Continuous** rather than bolus EN should be used.


Grade of Recommendation: B
Strong consensus (95% agreement)



In adult critically ill patients, does post-pyloric EN compared to gastric EN improve outcome (reduce mortality, reduce infections)?

- **In patients deemed to be at high risk for aspiration, post-pyloric, mainly jejunal feeding can be performed.**

Grade of Recommendation: Good practice point
Strong consensus (95% agreement)



In adult critically ill patients, does the administration of prokinetics improve outcome (reduce mortality, reduce infections)?

- **In critically ill patients with gastric feeding intolerance, intravenous erythromycin should be used as a first line prokinetic therapy.**

Grade of Recommendation: B
Strong consensus (100% agreement)

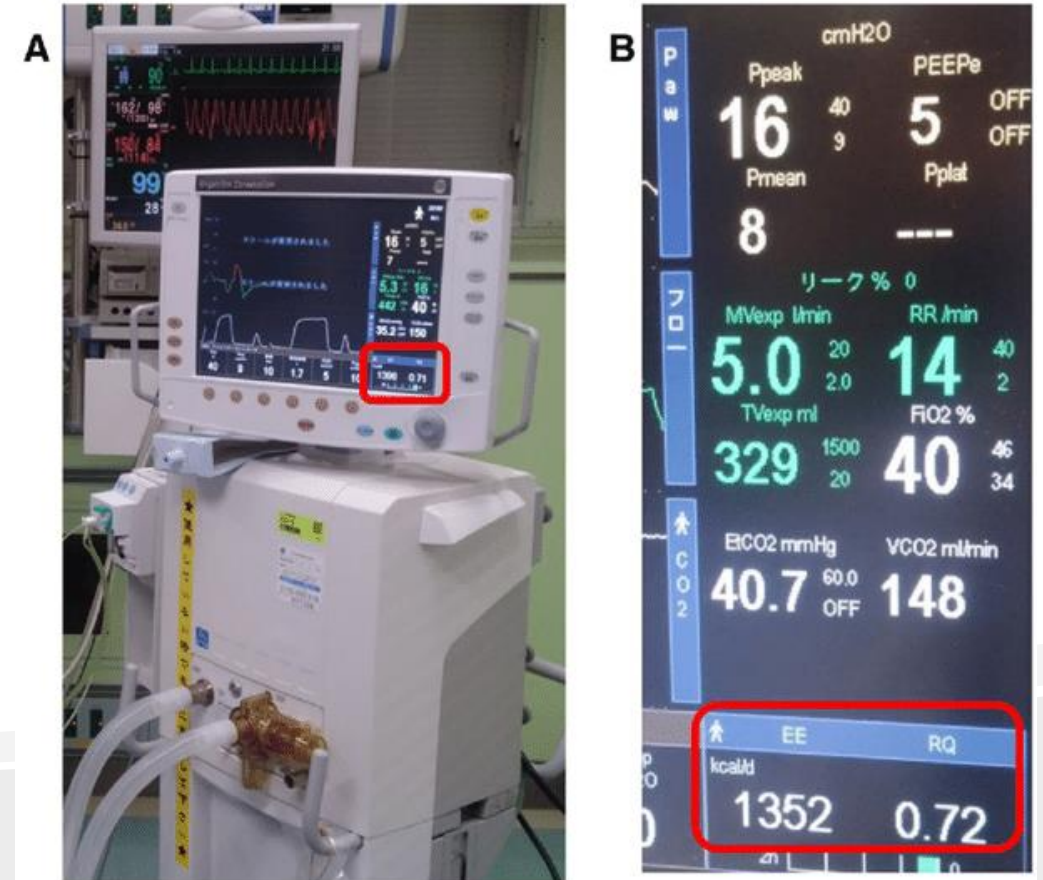
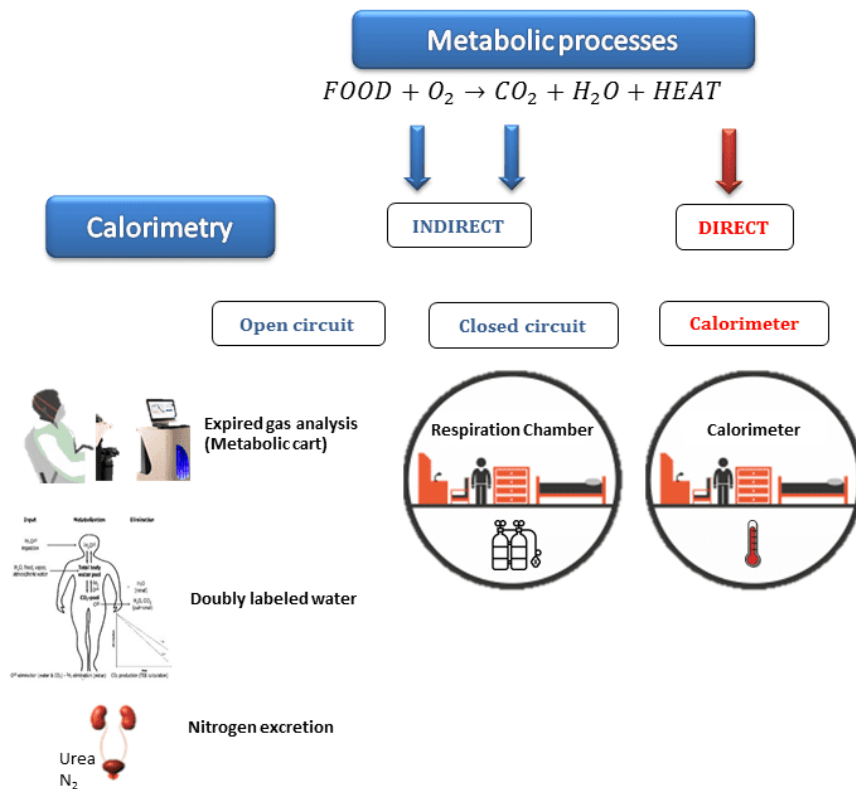
- **Alternatively, intravenous metoclopramide or a combination of metoclopramide and erythromycin can be used as a prokinetic therapy.**

Grade of Recommendation: O
Strong consensus (100% agreement)

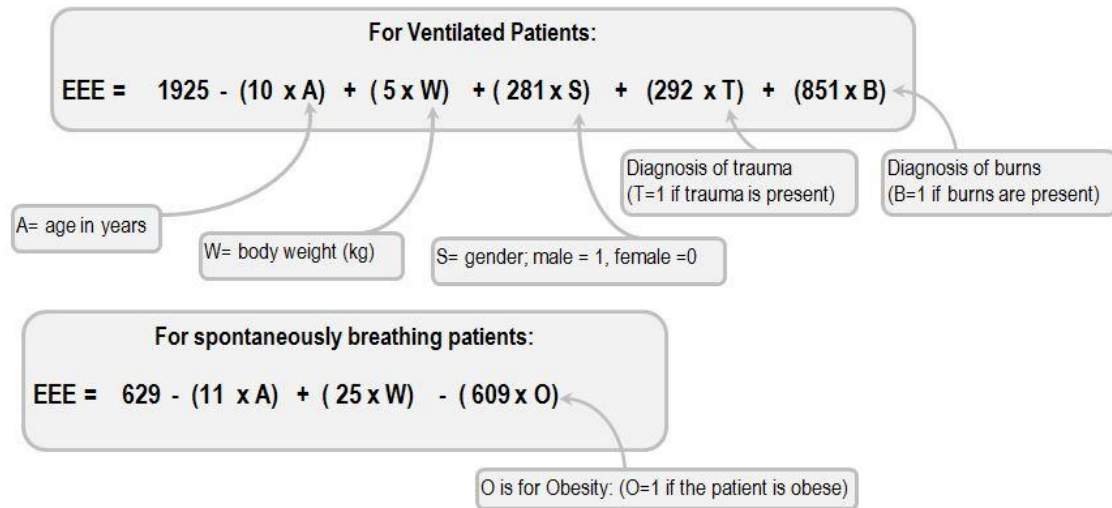
How to define the energy expenditure (EE)?

- In critically ill mechanically ventilated patients, EE should be determined by using indirect calorimetry.**

Grade of Recommendation: B
Strong consensus (95% agreement)




In critically ill patients for whom caloric needs are measured using indirect calorimetry or estimated using predictive equations, should isocaloric or hypocaloric nutrition be used?



- **If indirect calorimetry is used, isocaloric nutrition rather than hypocaloric nutrition can be progressively implemented after the early phase of acute illness**


Grade of Recommendation: O
Strong consensus (95% agreement)



In critically ill patients for whom caloric needs are measured using indirect calorimetry or estimated using predictive equations, should isocaloric or hypocaloric nutrition be used?

- **Hypocaloric nutrition (not exceeding 70% of EE) should be administered in the early phase of acute illness.**


Grade of Recommendation: B
Strong consensus (100% agreement)



In critically ill patients for whom caloric needs are measured using indirect calorimetry or estimated using predictive equations, should isocaloric or hypocaloric nutrition be used?

- **After day 3, caloric delivery can be increased up to 80-100% of measured EE.**

Grade of Recommendation: O
Strong consensus (95% agreement)



In critically ill patients for whom caloric needs are measured using indirect calorimetry or estimated using predictive equations, should isocaloric or hypocaloric nutrition be used?

- If predictive equations are used to estimate the energy need, **hypocaloric nutrition** (below 70% estimated needs) should be preferred over isocaloric nutrition for the **first week** of ICU stay.

Grade of Recommendation: B
Strong consensus (95% agreement)



When should we apply/implement supplemental PN?

- **In patients who do not tolerate full dose EN during the first week in the ICU, the safety and benefits of initiating PN should be weighed on a **case-by-case** basis.**

Grade of Recommendation: Good practice point
Strong consensus (96% agreement)


- **PN should not be started until all strategies to maximize EN tolerance have been attempted.**

Grade of Recommendation: Good practice point
Strong consensus (95% agreement)



When should we apply/implement supplemental PN?

- **ASPEN/SCCM recommend that in patients with either a low or high nutritional risk, the use of supplemental PN should be considered only **after 7-10 days** if they are **unable to meet >60% of energy** and protein requirements by the enteral route alone.**



In adult critically ill patients, does high protein intake compared to low protein intake improve outcome (reduce mortality, reduce infections)?

- **During critical illness, 1.3 g/kg protein equivalents per day can be delivered progressively**

Grade of Recommendation: O
Strong consensus (91% agreement)

The previous ESPEN guidelines recommended administering 1.2-1.5 g/kg/d protein based on three studies showing improvement in nitrogen balance

- ◆ Ishibashi N, Plank LD, Sando K, Hill GL. Optimal protein requirements during the first 2 weeks after the onset of critical illness. *Crit Care Med* 1998;26:1529–35.
- ◆ Larson J, Ljijedahl SO, Schildt B, Furst P, Vinnars E. Metabolic studies in multiple injured patients. Clinical features, routine chemical analysis and nitrogen balance. *Acta Chir Scand* 1981;147:317–24.
- ◆ Shaw JH, Wildbore M, Wolfe RR. Whole body protein kinetics in severely septic patients. The response to glucose infusion and total parenteral nutrition. *Ann Surg* 1987;205:288–94.




What are the optimal combinations of carbohydrates and fat during EN and PN?

- **The amount of glucose (PN) or carbohydrates (EN) administered to ICU patients should **not exceed 5 mg/kg/min****

Grade of Recommendation: Good practice point
Strong consensus (100% agreement)

Glucose intolerance: need higher insulin



What are the optimal combinations of carbohydrates and fat during EN and PN?

- **The administration of intravenous lipid emulsions should be generally a part of PN.**
- **Intravenous lipid (including non-nutritional lipid sources) should **not exceed 1.5 g lipids/kg/day** and should be adapted to individual tolerance.**

Grade of Recommendation: Good practice point
Strong consensus (100% agreement)

Impair fat absorption



The recent expert recommendations indicated that a blend of essential fatty acids should be considered

- **medium chain triglycerides (MCTs)**
- **n-9 monounsaturated FAs**
- **n-3 polyunsaturated FAs**



Should we use additional enteral/ parenteral glutamine (GLN) in the ICU?

- In patients with **burns > 20%** body surface area, additional **enteral doses of GLN** (0.3-0.5 g/kg/d) should be administered for **10-15 days** as soon as EN is commenced.

Grade of Recommendation: B
Strong consensus (95% agreement)



Should we use additional enteral/ parenteral glutamine (GLN) in the ICU?

- In critically ill **trauma**, additional EN doses of GLN (0.2-0.3 g/ kg/d) can be administered for the **first five days** with EN. In case of complicated **wound healing** it can be administered for a longer period of **10-15 days**.

Grade of Recommendation: O
Strong consensus (91% agreement)



Should we use additional enteral/ parenteral glutamine (GLN) in the ICU?

- **In unstable and complex ICU patients, particularly in those suffering from liver and renal failure, parenteral GLN -dipeptide shall not be administered.**

Grade of Recommendation: A
Strong consensus (92.31% agreement)



Should we use additional enteral/ parenteral glutamine (GLN) in the ICU?

- **In ICU patients except burn and trauma patients, additional enteral GLN should not be administered.**

Grade of Recommendation: B
Strong consensus (92.31% agreement)

Glutamine: A well conducted meta-analysis including four trials concluded that GLN supplementation was associated with a significant reduction of infectious complications, and of mortality due to bacteremia



Should we use enteral/parenteral EPA/ DHA?

- **Parenteral lipid emulsions enriched with EPA + DHA (Fish oil dose 0.1-0.2 g/kg/d) can be provided in patients receiving PN.**

Grade of Recommendation: O
Strong consensus (100% agreement)



Should we use enteral/parenteral EPA/ DHA?

- **Parenteral lipid emulsions enriched with EPA + DHA (Fish oil dose 0.1-0.2 g/kg/d) can be provided in patients receiving PN.**

Grade of Recommendation: O
Strong consensus (100% agreement)

Meta-analyses have shown an advantage to lipid emulsions enriched in fish oil or olive oil



Should we use parenteral micronutrients and antioxidants in critically ill patients?

- **To enable substrate metabolism, micronutrients (i.e. trace elements and vitamins) should be provided daily with PN.**

Grade of Recommendation: B
Strong consensus (100% agreement)

Vitamin C**, Vitamin D**



Nutritional therapy in special conditions



EN should be delayed

Septic shock

- **If shock is uncontrolled** and hemodynamic and tissue perfusion goals are not reached.
- In case of uncontrolled life-threatening hypoxemia, hypercapnia or acidosis.
- In patients suffering from active upper GI bleeding.
- In patients with overt bowel ischemia
- In patients with high-output intestinal fistula if reliable feeding access distal to the fistula is not achievable
- In patients with abdominal compartment syndrome
- If gastric aspirate volume is above 500 ml/6 h.

Grade of Recommendation: B
Strong consensus (100% agreement)



Low dose EN should be administered

- **In patients receiving therapeutic hypothermia and increasing the dose after rewarming**
- **In patients with intra-abdominal hypertension without abdominal compartment syndrome**
- **In patients with acute liver failure when acute, immediately life-threatening metabolic derangements are controlled with or without liver support strategies, independent on grade of encephalopathy**

Grade of Recommendation: B
Strong consensus (95.65% agreement)



Early EN should be performed

- **In patients receiving ECMO**
- **In patients with traumatic brain injury**
- **In patients with stroke (ischemic or hemorrhagic)**
- **In patients with spinal cord injury**
- **In patients with severe acute pancreatitis**
- **In patients after GI surgery**

Grade of Recommendation: B
Strong consensus (95.83% agreement)



Early EN should be performed

- **In patients after abdominal aortic surgery**
- **In patients with abdominal trauma when the continuity of the GI tract is confirmed/restored**
- **In patients receiving neuromuscular blocking agents**
- **In patients managed in prone position**
- **In patients with open abdomen regardless of the presence of bowel sounds unless bowel ischemia or obstruction is suspected in patients with diarrhea**

Grade of Recommendation: B
Strong consensus (95.83% agreement)



Special conditions not included in the ESICM recommendations

- **Early and progressive EN should be used in septic patients after hemodynamic stabilization. If contraindicated, EN should be replaced by progressive PN**

Grade of Recommendation: Good practice point
Strong consensus (94% agreement)



Critically ill patients with surgical complications after abdominal or esophageal surgery

- **In patients after abdominal or esophageal surgery, early EN can be preferred over delayed EN.**

Grade of Recommendation: O
Strong consensus (96% agreement)



Critically ill patients with surgical complications after abdominal or esophageal surgery

- **In critically ill patients with surgical complications after abdominal or esophageal surgery and unable to eat orally, EN (rather than PN) should be preferred unless discontinuity or obstruction of GI tract, or abdominal compartment syndrome is present.**

Grade of Recommendation: Good practice point
Strong consensus (96% agreement)



Critically ill patients with surgical complications after abdominal or esophageal surgery

- **In the case of an unrepaired anastomotic leak, internal or external fistula, a feeding access distal to the defect should be aimed for to administer EN.**

Grade of Recommendation: Good practice point
Strong consensus (95.83% agreement)



Critically ill patients with surgical complications after abdominal or esophageal surgery

- **In the case of an unrepaired anastomotic leak, internal or external fistula, or if distal feeding access is not achieved, EN should be withheld and PN may be commenced.**

Grade of Recommendation: Good practice point
Strong consensus (100% agreement)



How should head trauma patients be fed?

- **Trauma patients should preferentially receive early EN instead of early PN.**

Grade of Recommendation: B
Strong consensus (96% agreement)




How should obese patients be fed?

- In obese patients, energy intake should be guided by indirect calorimetry.
- Protein delivery should be guided by urinary nitrogen losses or lean body mass determination (using CT or other tools).
- If indirect calorimetry is not available, energy intake can be based on **“adjusted body weight”**.
- If urinary nitrogen losses or lean body mass determination are not available, protein intake can be 1.3 g/kg **“adjusted body weight”**/d.


Adjusted body weight = actual body weight - ideal body weight) x 0.33 + ideal body weight.

Grade of Recommendation: Good practice point
Strong consensus (89% agreement)



How should nutrition therapy be monitored during the ICU stay?


- **The main goals of monitoring of nutrition therapy in the ICU are:**
 - a) To assure that optimal nutritional support is planned and provided as prescribed regarding energy, protein and micronutrient targets
 - b) To prevent or detect any possible complication
 - c) To monitor response to feeding and detect refeeding
 - d) to detect micronutrient deficiencies in patient categories at risk.



Which laboratory parameters should be monitored?

- **Blood glucose should be measured initially (after ICU admission or after artificial nutrition initiation) and at least every 4 h, for the first two days in general.**

Grade of Recommendation: Good practice point
Strong consensus (93% agreement)




Which laboratory parameters should be monitored?

- **Insulin shall be administered, when glucose levels exceed 10 mmol/L. (180 mg%)**

Grade of Recommendation: A
Strong consensus (93% agreement)


Best target 6-8 mmol/L = 100-144 mg%



Which laboratory parameters should be monitored?

- **Electrolytes (potassium: K, magnesium: Mg, phosphate: PO₄) should be measured at least **once daily for the first week.****


Grade of Recommendation: Good practice point
Strong consensus (92% agreement)



Which laboratory parameters should be monitored?

- **In patients with refeeding hypophosphatemia (< 0.65 mmol/ l or a drop of > 0.16 mmol/l), electrolytes should be measured 2- 3 times a day and supplemented if needed.**

Grade of Recommendation: Good practice point
Strong consensus (100% agreement)



Which laboratory parameters should be monitored?

- **In patients with refeeding hypophosphatemia energy supply should be restricted for 48 h and then gradually increased.**

Grade of Recommendation: B
Strong consensus (100% agreement)



Thank you for your
attention

Question?