ESPEN LLL Course Topic 18 - Nutritional Support in Intensive Care Unit Patients





THE EUROPEAN SOCIETY FOR CLINICAL NUTRITION AND METABOLISM

How to Choose the Best Route of Feeding. An ICU Clinical Case

Module 18.4

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01.09.2019

ESPEN LLL Programme

Learning objectives





- THE EUROPEAN SOCIETY FOR CLINICAL NUTRITION AND METABOLISM
- To define the indications and contraindications of oral, enteral and parenteral nutrition
- To define how to select the best route of feeding
- To discuss the need for combination of two routes of nutrition support
- Key messages:
- Enteral is the preferred route of feeding, whenever oral intakes do not cover the nutritional needs
- Parenteral nutrition is indicated in case of failure of enteral nutrition or severely impaired digestive

Case description





• 61 year old obese patient is driven to the operation room for

THE EUROPEAN SOCIETY FOR CLINICAL NUTRITION AND METABOLISM emergency laparotomy in order to cure a mesenteric infarction under general anesthesia.

- Personal history: Obesity since adolescence, treated hypertension for > 20 yrs, diabetes Type II and hyperlipidemia treated for > 10 yrs, smoking > 20 /day, alcoholism for > 10 years, sedentary lifestyle. No previous abdominal surgery
- **Physical condition:** Body weight 125 kg, 173 cm, BMI 41.8, conscious, no pain reported including during abdominal examination, red blood during rectal examination







Emergency surgery (Day 0), on general anesthesia

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- Open abdomen revealed extensive jejunal necrosis with perforation
- > 2.4 L of intrabdominal fluid, some blood and pus
- Resection of the necrotic jejunal segment (~ 130 cm). Terminal jejunostomy
- Admission to the ICU

Intensive Care Unit





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On admission Day 0 :

- Patient on ventilator (40% FiO₂)
- Noradrenaline 0,28 µg/kg/min, 7 L of cristalloids
- Urine output 25ml/h
- Sedation: Propofol 300 mg/h + Fentanyl 100 µg/h
- Antibiotic: Cefuroxime 1,5 g x 3 i.v.; Metronidazol 500 mg x 3 i.v.
- Hb: 9.7 g/L
- pO₂ :108 mm Hg
- pCO₂ : 47,8 mmHg
- pH: 7.31
- Lactic acid: 2.4 mmol/L
- Base excess: 5.0
- Glycemia: 14.5 mmol/L

- K: 2.8 mmol/L
- Mg: 0.4 mmol/L
- PO4: 0.35 mmol/L
- Creatinine : 110 mmol/L
- Urea: 13.1 mmol/L







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FOR CLINICAL NUTRITION AND Would you start nutrition support immediately ?

- No, the patient is obese and therefore not at nutritional risk.
- No, the patient needs resuscitation first, including correction of abnormal electrolytes
- Yes, the patient is a critically ill patient and needs immediate and full nutrition support

ESPEN Question 2





THE EUROPEAN SOCIETY FOR CLINICAL NUTRITION AN METABOLISM After 11 hours in the ICU, blood gases and arterial pressure are reasonably controlled. Electrolytes have been corrected by intravenous administration. Would you start nutrition support ?

- a. Enteral nutrition to be started immediately using diluted enteral feed (50% water) at 100 ml/hr
- b. Enteral nutrition to be started at low rate (20ml/hr) and increased as tolerated to reach the energy target by Day 3-4 after ICU admission
- c. Endoscopy-inserted nasojejunal tube to be placed within 24 hours and clear fluid administered for 24 hrs to stimulate the gut function
- Full nutrition support immediately prescribed to cover 100% of the energy needs



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Nutrition in the ICU Education and Culture DG Lifelong Learning Programme P Singer et al. Clin Nutr 2019, 38: 48-79





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Intensive Care Unit -Day 2



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On the next morning

- Still on full sedation (Propofol 300 mg/h = 360 kcal/24h) and ventilation
- FiO₂ 30%, BP 110/70 mmHg, heart rate 90/min
- Urinary output 60ml/h, noradrenalin 0.2 µg/kg/min
- pH 7.40, lactate 2.0 mmol/l
- C-reactive protein 115 mmol/l
- Glycemia 10.5 mmol/l, insulin 3 units/hr
- Isocaloric enteral nutrition (1 kcal/ml) through the nasogastric tube : 20 ml/hr







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Q3: What is the energy target ?

- According to predicting formula for obese. patients : 125 kg X 14 kcal/kg= 1750 kcal
- b. According to predicting formula: 125 kg X 20 kcal/kg= 2500 kcal
- According to predicting formula: 125 kg X 25 kcal/kg= 3125 kcal
- d. According to the Harris-Benedict formula : 2246 kcal



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Nutrition in the ICU P Singer et al. Clin Nutr 2019, 38: 48-79



N	Recommendation	Grade
L	15 . EE should be determined in mechanically ventilated patients by using indirect calorimetry (IC) .	B 95%
	Statement 2 If IC is not available, using VO_2 (oxygen consumption) from pulmonary arterial catheter or VCO_2 (CO ₂ production) derived from the ventilator with better evaluation on EE than predictive equations.	82% agreement
	In the absence of IC or VO ₂ or VCO ₂ measurements -> use of simple weight-based equations: 20-25 kcal/kg/d simplest option may be preferred.	



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ESPEN Intensive Care Unit - Day 3





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- Chest X-Ray \rightarrow bilateral pneumonia
- FiO2 60%, Positive End Expiratory Pressure 14
- Base excess : 8.2, lactic acid : 3.9 mmol/L
- BP 110/70 mmHg, heart rate 90/min
- Urinary output 40ml/h, noradrenalin 0.2 µg/kg/min
- pH 7.40, lactate 2.0 mmol/l
- C-reactive protein 245 mmol/l
- Glycemia 7.2 mmol/l, insulin 2 units/hr
- Isocaloric enteral nutrition (1 kcal/ml) by gastric tube : maintained at 20 ml/hr.
- Repeated vomiting, abdominal distension

Intensive Care Unit - Day 4





- THE EUROPEAN SOCIETY FOR CLINICAL NUTRITION AND METABOLISM
- Clinical conditions: similar to Day 3
- Indirect calorimetry: 1605 kcal/24h
- Calculated cumulated energy deficit: 4X 1605 = 5620 1325 = 4295 kcal
- Enteral nutrition 1 kcal/ml by nasogastric tube : maintained at 20 ml/hr due to persistent regurgitation

Question 4





THE EUROPEAN SOCIETY FOR CLINICAL NUTRITION AND METABOLISM How can nutrition support be optimized:

- 1. Enteral nutrition should be maintained at 20 ml /hr until improvement of the gut function
- 2. Enteral nutrition should be increased to 50 then 75 ml /hr despite persistent regurgitation
- 3. Full parenteral nutrition (i.e. 2500 kcal/d) should be started in order to minimize further energy deficit and compensate for insufficient intake during the 3 first days (energy deficit = 4295 kcal) in the ICU. Enteral nutrition should be stopped.
- 4. Supplemental parenteral nutrition should be started according to supplement insufficient enteral nutrition to reach measured energy target (i.e. 1605 300 kcal (Propofol) = 1300 kcal/d)



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Nutrition in the ICU P Singer et al. Clin Nutr 2019, 38: 48-79







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Significant improvement of the lung conditions \rightarrow FiO₂ reduced to 25%.

Sedation reduced to night period

Suspicion of peritonitis secondary to anastomotic leak. Abdominal lavage: no leak Persistent regurgitation

Enteral nutrition : 25 ml/hr = 600 kcal/d,

SPN = 900 kcal/24hr (! Propofol = 100 kcal)

Glycemia 7.5 mml/L, Insulin 2 IU/hr

Intensive Care Unit: Day 7



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Further improvement of the clinical conditions Weaning of the ventilator initiated

No regurgitation observed

Indirect calorimetry: 1595 kcal/d

Calculated cumulated energy deficit: $7 \times 1600 =$ 11200 - 6900 = 4300 kcal

Enteral nutrition increased to 50 ml/hr = 1200 kcal/d, SPN reduced to 400 kcal/d

Insulin : 2 IU/hr, glycemia 7.5 mml/L

Question 5





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- How can nutrition support be optimized:
- Enteral nutrition should be increased immediately to the energy target: 1600 ml/day and Supplemental parenteral nutrition immediately stopped
- 2. Enteral nutrition should be prescribed at 50ml /hr and progressively increased up to energy target (i.e. 1605 kcal/d) and Supplemental parenteral nutrition reduced as the amount of Enteral nutrition increases
- 3. Both Enteral nutrition and Supplemental parenteral nutrition should be maintained as they are (i.e. 50ml /hr and 400 kcal/d, respectively) until discharge to guarantee full provision of energy needs
- 4. Enteral nutrition and and Supplemental parenteral nutrition immediately stopped. Oral nutritive supplements should be proposed as the patient is a awake



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Recommendation	Grade
20. Start SPN in patients who do not tolerate full dose EN during the 1 st week in the ICU.	GPP 96%
Safety and benefits to start PN should be weighed on a case-by-case basis.	
21. PN should not be started until all strategies to maximize EN tolerance have been attempted.	GPP 95%

Intensive Care Unit: Day 9



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Weaned of the ventilator, the patient is transferred to the surgical ward

Increased of Enteral nutrition to reach the measured energy target (1600 kcal/d)

SPN is stopped

Enteral nutrition is maintained at discharge from the ICU as important swallowing disorders are observed

The overall energy deficit during the ICU stay is 4300 kcal

ESPEN Take home message





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- First 2–3 days : endogenous energy source is important
- After 3-4 days, exogenous supply of energy is vital
- Try enteral nutrition: 20 ml/hr, then increase according to

tolerance

- Energy needs is easily measured by calorimetry
- In case of failure of enteral nutrition, supplemental parenteral nutrition is required. Avoid overfeeding !
- Energy deficit (> 4000 kcal during the ICU stay) \rightarrow

complications \rightarrow monitoring of intake is mandatory