Pécsi Tudományegyetem
1367

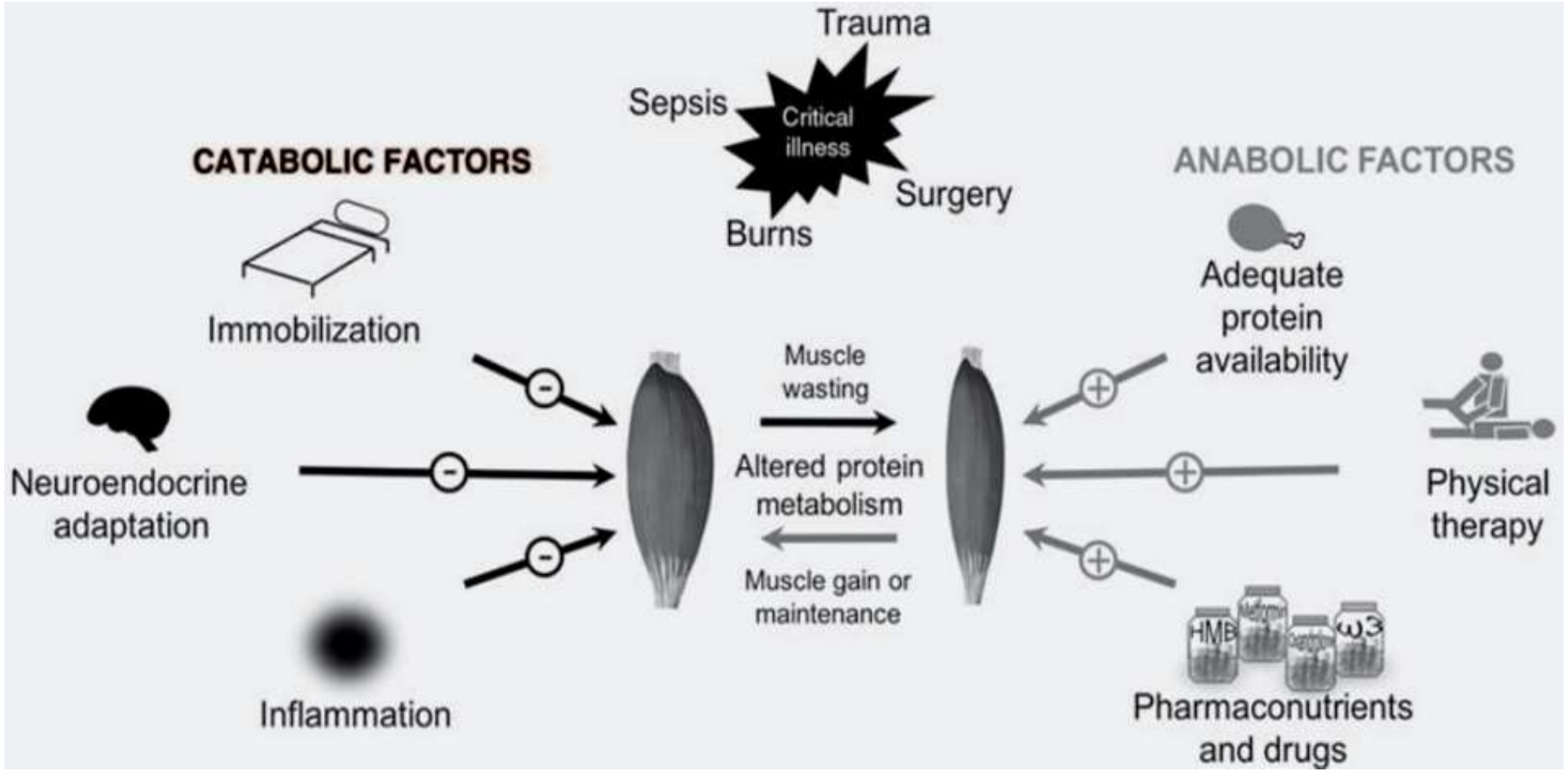
Fehérjék és lipidek betegorientált célértékei

Csontos Csaba

PTE KK AITI

Filippo G. Di Girolamo, Roberta Situlin, and Gianni Biolo
Curr Opin Clin Nutr Metab Care 2017, 20:124–130

What factors influence protein synthesis and degradation in critical illness?



Következmény:

súlyos vázizom veszteség, **„ICU aquired weakness”** mely magas mortalitáshoz vezet, akár 1 év múlva is

Clinical Nutrition 42 (2023) 1671–1689

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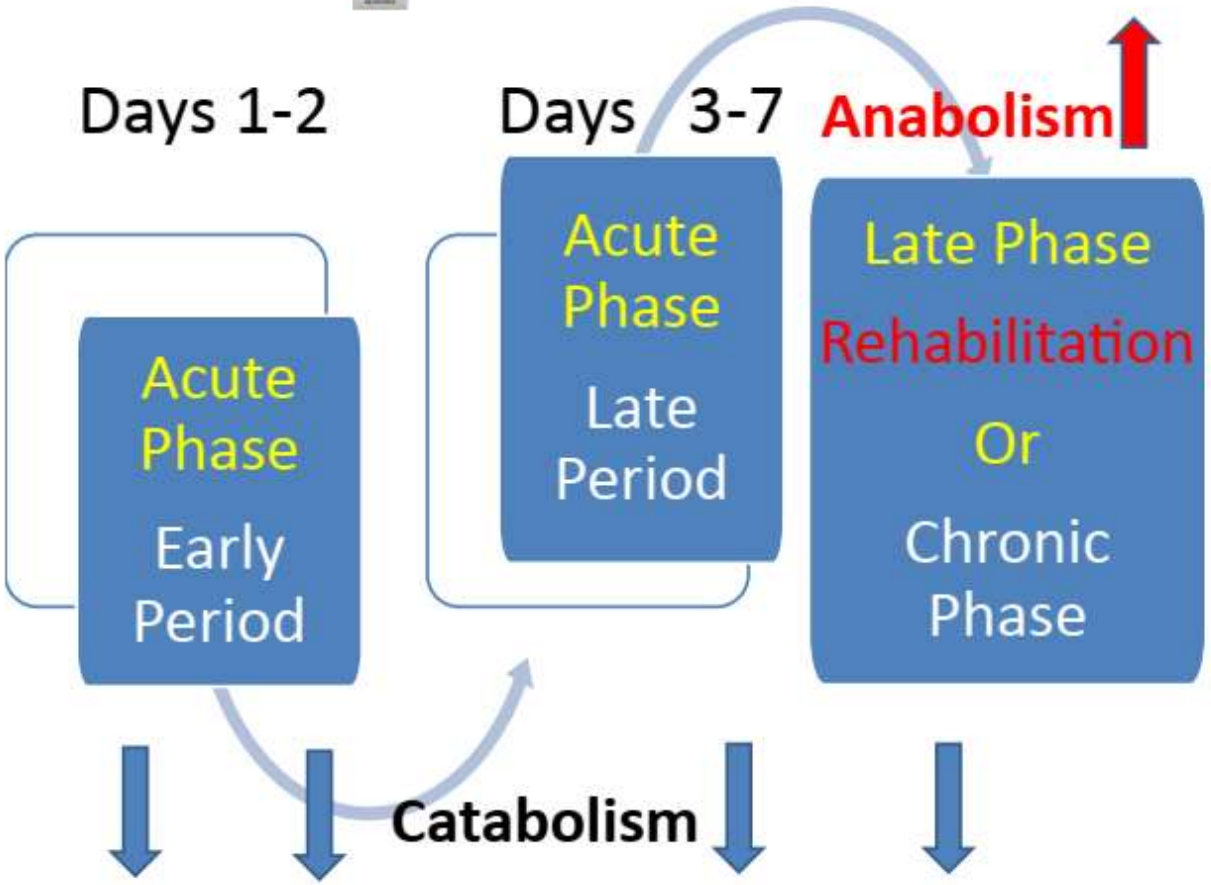

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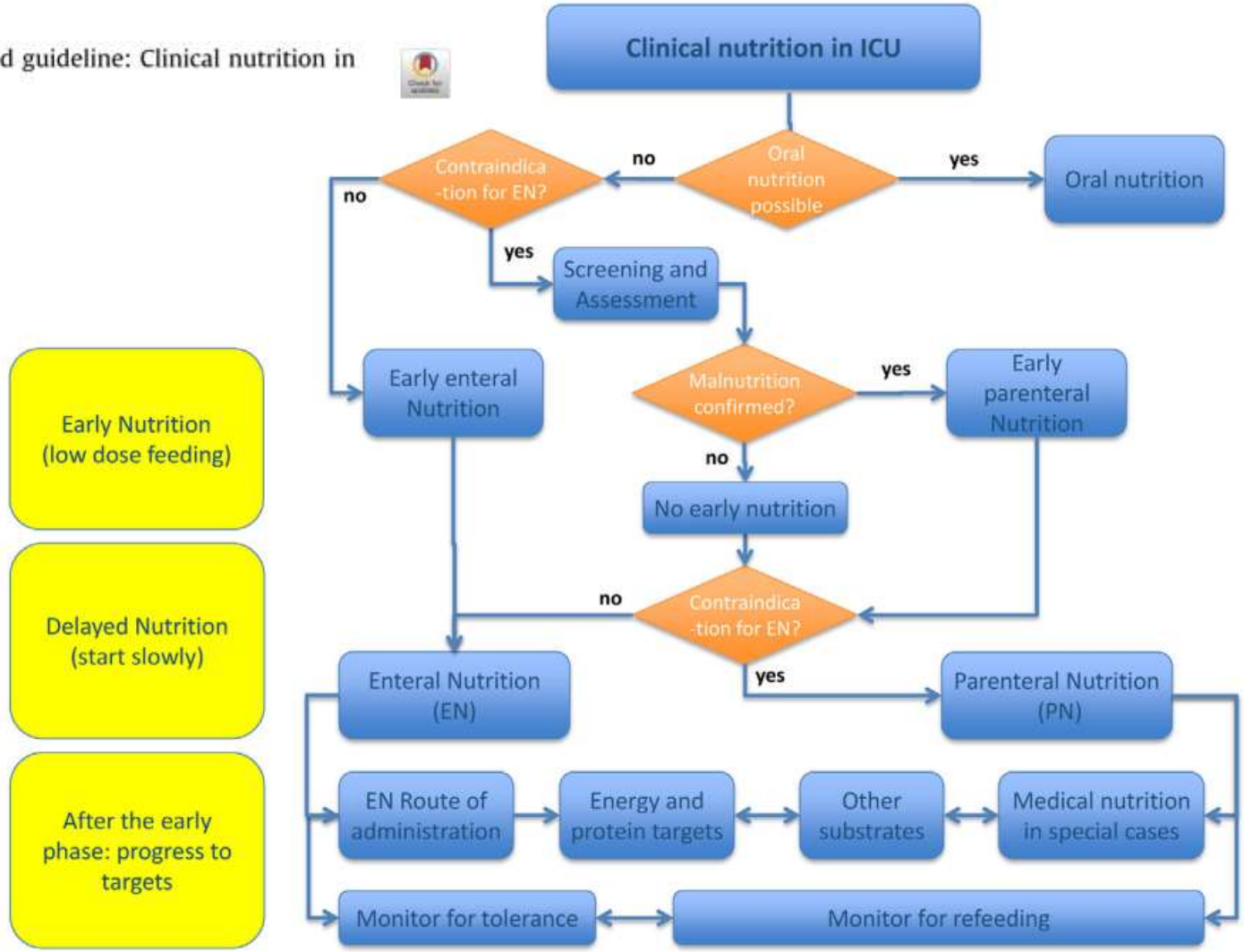

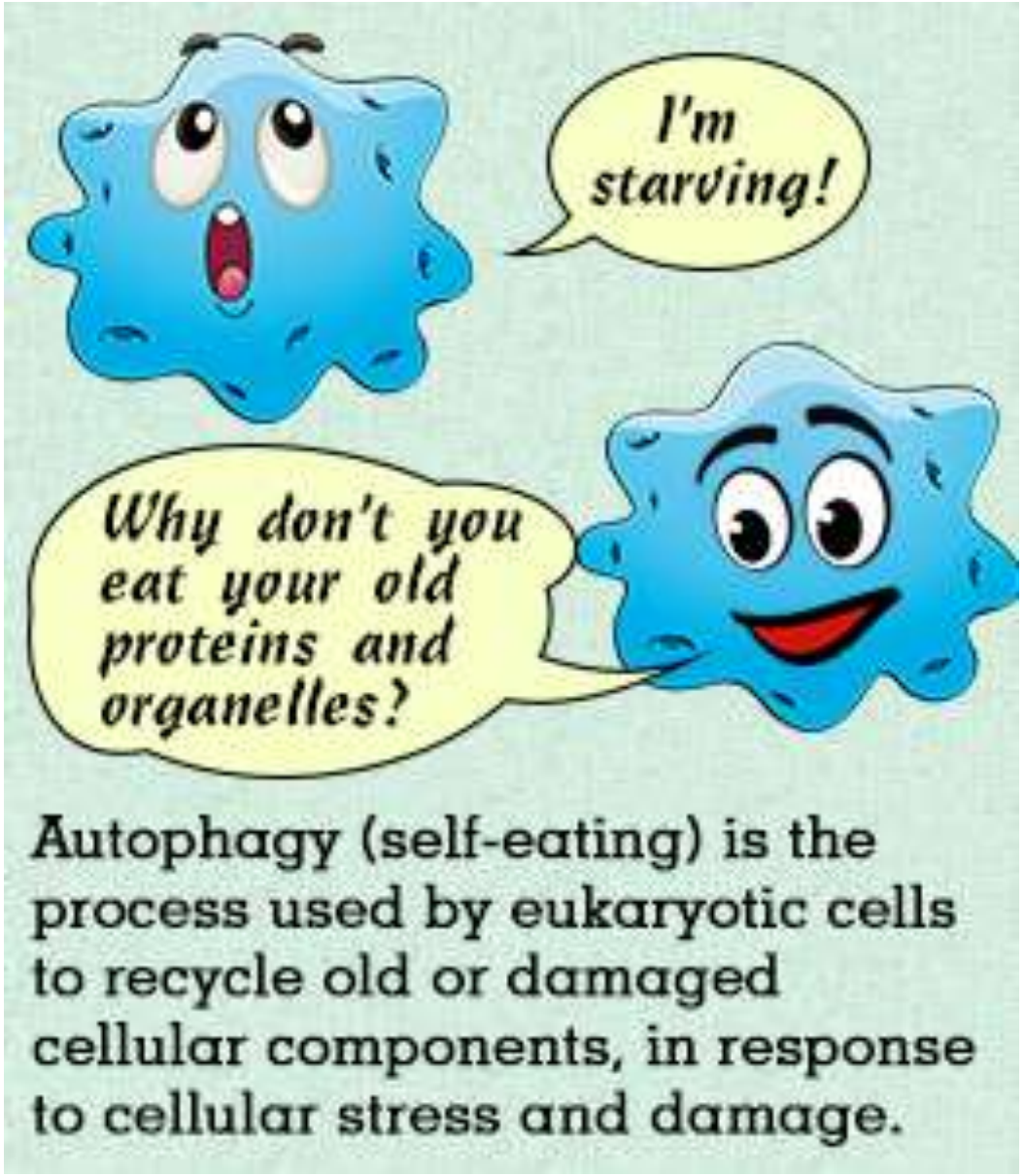

A metabolikus stressz szakaszában – amennyiben nem adagoljuk túl a glukóz/inzulint - úgy tűnik, a magasabb (PN) aminosav-szinttel függ össze az autophagia gátlása.

Ferrie et al.: JPEN 2016.

McClave Cur Op Clin Nutr Met Care 2015 18:155-161


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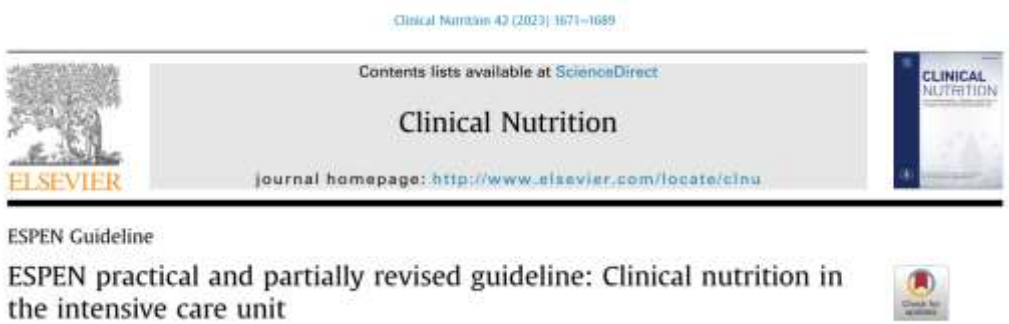
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- **19. ajánlás**: Ha az energiaigény becsléséhez prediktív egyenleteket használnak, az intenzív osztályon töltött első héten az izokalorikus táplálkozás helyett a hipokalorikus táplálkozást (a becsült igény 70% alatti) kell előnyben részesíteni. Ajánlás fokozata: B, erős konszenzus (95% egyetértés).
- **22. ajánlás**: Kritikus állapotban napi 1,3 g/kg fehérje-egyenérték adagolható fokozatosan. Az ajánlás fokozata: 0 erős konszenzus (91%egyetértés)
- **3. állítás**: A fizikai aktivitás javíthatja a táplálkozási terápia jótékony hatásait. Konszenzus (86% egyetértés)

DOI: 10.1002/jpen.2267

CLINICAL GUIDELINES

Guidelines for the provision of nutrition support therapy in the adult critically ill patient: The American Society for Parenteral and Enteral Nutrition

Charlene Compher PhD, RD[1] | Angela L. Bingham PharmD[2,3] | Michele McCall MSc, RD[4] | Jayshil Patel MD[5] | Todd W. Rice MD, MSc[6] | Carol Braunschweig PhD[7] | Liam McKeever PhD, RDN[7]

Guideline question 2. In adult critically ill patients, does provision of higher as compared with lower protein intake impact clinical outcomes?

Evidence GRADE: Low

GRADE recommendation: There was no difference in clinical outcomes in the relatively limited data. Because of a paucity of trials with high-quality evidence, we cannot make a new recommendation at this time beyond the 2016 guideline suggestion for 1.2–2.0 g/kg/day.

Strength of GRADE recommendation: Weak

Discussion on clinical application for question 2: Few studies have investigated the impact of higher protein doses provided with equivalent energy; thus, the impact on outcomes is not known. Until more data are available, we suggest clinicians should individualize protein prescriptions based on clinician judgment of estimated needs.

Nagyobb igény: égett, trauma, obes

Clinical Guidelines

Guidelines for the Provision and Assessment of Nutrition Support Therapy in the Adult Critically Ill Patient: Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.)

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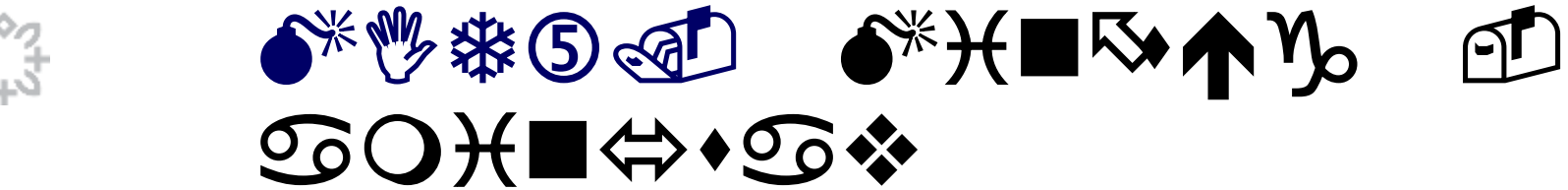
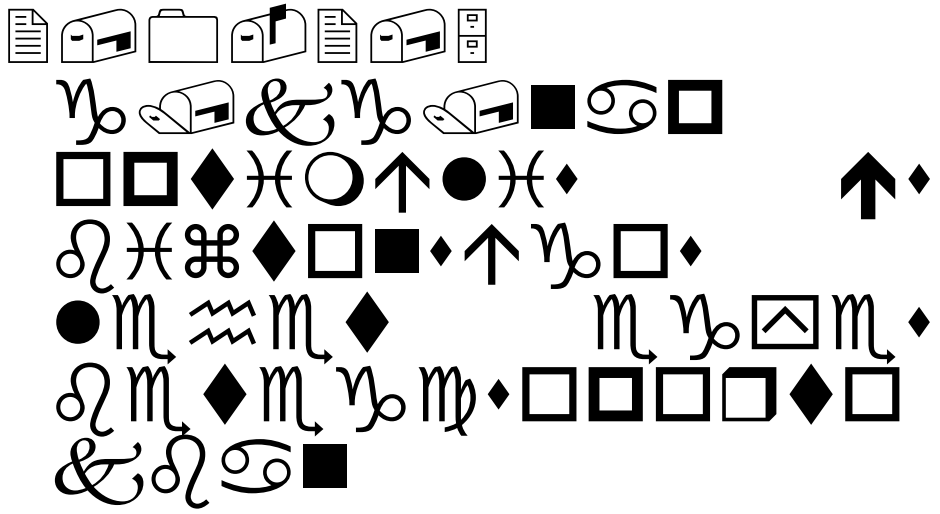
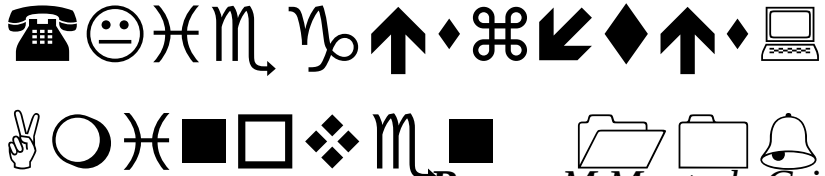
- E1. A szakértői konszenzus alapján javasoljuk, hogy az intenzív osztályon az EN kezelés megkezdésekor standard polimer formula használatát alkalmazzák. Javasoljuk, hogy kerüljék a speciális formulák rutinszerű alkalmazását a MICU-ban lévő kritikus állapotú betegeknél és a betegségspecifikus formulák alkalmazását a SICU-ban.







Van ajánlás

- **Obesitas 2-2.5 g/kg**
- Neurotrauma 1.3-1.5 g/kg
- Lélegeztetett 1.5-1.8 g/kg
- **Súlyos égés 1.5-2.0 g/kg**
- Kardiológia 1.2-1.5 g/kg
- Gastrointestinalis sebészet 1.2-1.5 g/kg
- Akut veseelégtelenség
  - ✓ Alacsony katabolizmus 0.6-0.8 g/kg
  - ✓ Közepes katabolizmus 1.0-1.5 g/kg
  - ✓ Hyperkatabolizmus 1.7-2.2 g/kg
  - ✓ **CRRT** **max 2,5g/kg**

***Berger** M.M. et al: Crit Care 2012; 16:215.,*

Guidelines for specialized nutritional and metabolic support in the critically-ill patient. Update. Consensus SEMICYUC-SENPE, Nutr Hosp 2011; 26 (Supl. 2)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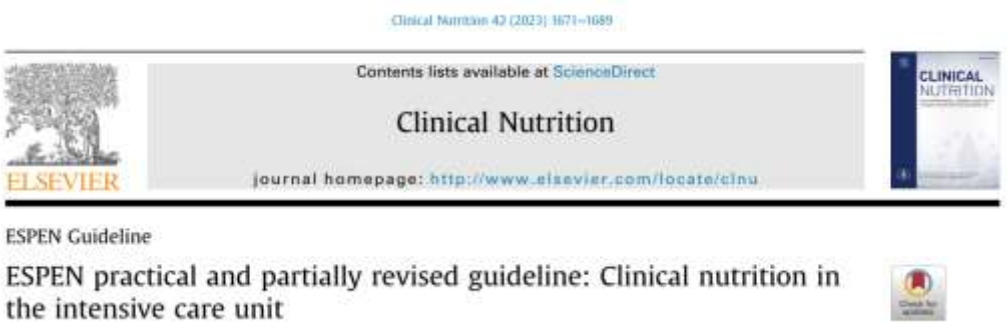
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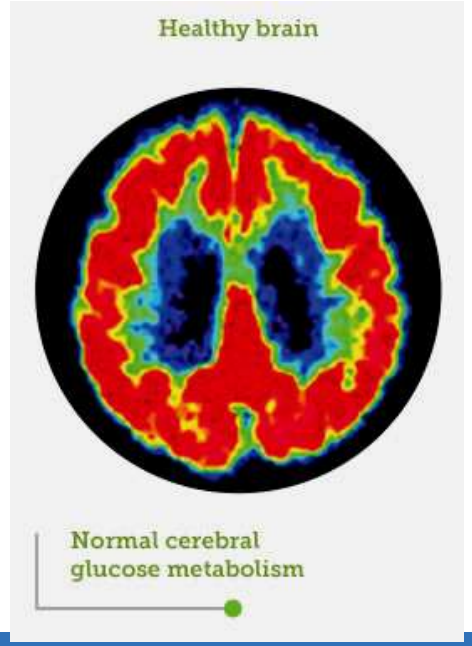
- **23. ajánlás**: Az intenzív osztályon kezelt betegeknek adott glükóz (PN) vagy szénhidrát (EN) mennyisége nem haladhatja meg az 5 mg/kg/perc értéket. Az ajánlás minősítése: GPP erős konszenzus (100%egyetértés)
- **24. ajánlás**: Az intravénás lipidemulziók adagolása általában a PN részét kell képezze. Az ajánlás minősítése: GPP- erős konszenzus (100%egyetértés)

MIT….Glukóz és a szervek

Totális glukóz igényes sejtek, szövetek:
vvt, leukocita, kornea, szemlencse, retina, vese velőállomány …

Agy

- legnagyobb glukóz felhasználó szövet: 100-120 g/nap
- hipoglikémiás kóma irreverzibilis károsodáshoz vezethet
- ketontestekből is képes glukózt szintetizálni

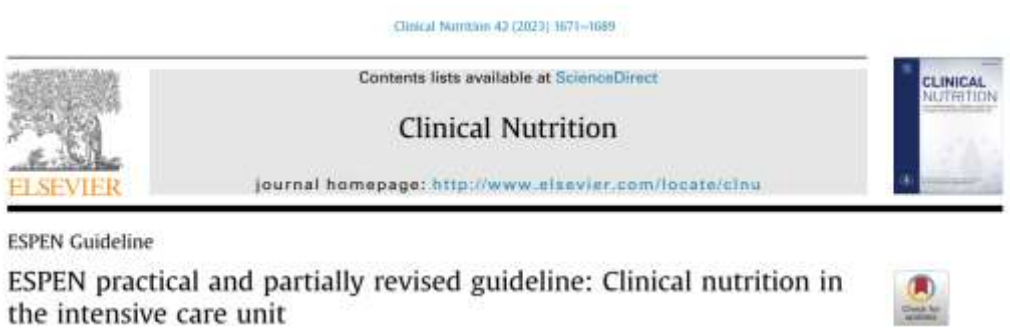


MIT…. Glukóz

- Minimum **2 g/kg/nap** felnőtt alapszükséglet
- Cél: 5-6 g/kg/nap
- Glukóz a totál kalória 50-70%-át fedezze.
- De, .. **ne haladja meg az 5 mg/kg/min** mennyiséget.
- Biztonságos minimális glukóz bevitel: **150 g/nap**.
- Túltáplálás egyértelműen növeli a mortalitást.
- **CRRT** – citrát ⇒ növeli a nem táplálékkal történő szénhidrát bevitelt, beleszámítani !

ESPEN GL on clinical nutrition in the ICU: Clin Nutr 2018; 1-32

Wiener: JAMA 2008; 300: 933-44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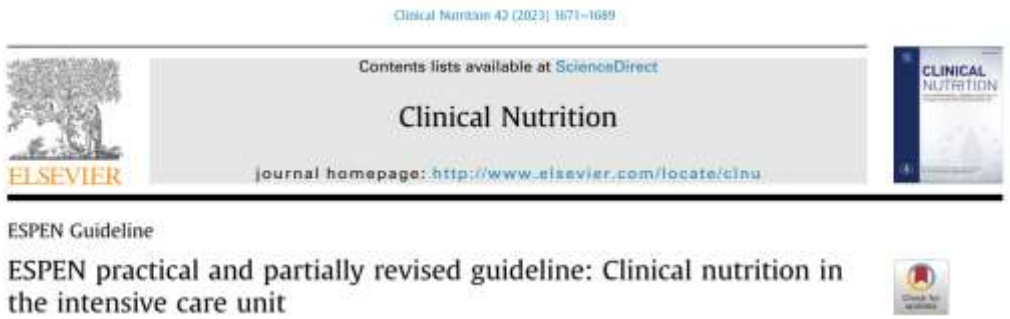
- **29)** Az intravénás lipid (beleértve a nem táplálkozási célú lipidforrásokat is) nem haladhatja meg az 1,5 g lipid kg/nap mennyiséget, és az egyéni toleranciához kell igazítani. (GPP fokozat, erős konszenzus, 100%)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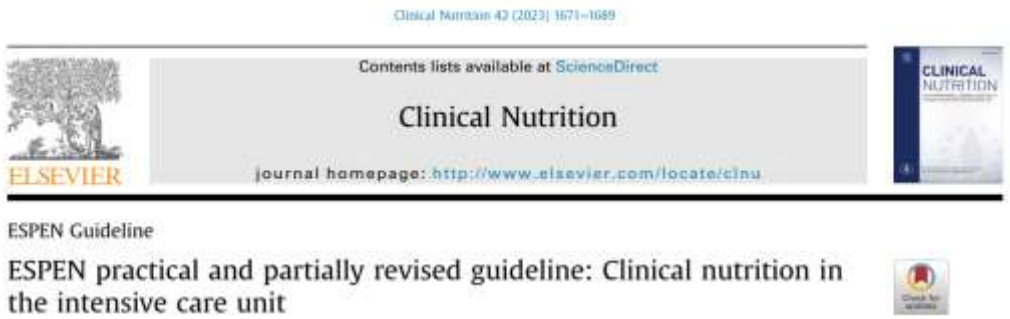
- A lipidemulziók zsírsav-összetételét illetően a legújabb szakértői ajánlások szerint fontolóra kell venni olyan zsírsavkeverék alkalmazását, amely közepes láncú triglicerideket (MCT-ket), n-9 egyszeresen telítetlen zsírsavakat és n-3 többszörösen telítetlen zsírsavakat tartalmaz.
- Jelenleg a nem sebészeti beavatkozáson átesett intenzív terápiás betegeknél alkalmazott, n-3 zsírsavval dúsított emulziókra vonatkozó bizonyítékok nem elégségesek ahhoz, hogy azok önálló kezelésként ajánlhatók legyenek.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Guidelines for the Provision and Assessment of Nutrition Support Therapy in the Adult Critically Ill Patient: Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.)

- E2. Javasoljuk, hogy az immunmoduláló enterális készítményeket (arginin más hatóanyagokkal, beleértve az eikozapentaén savat [EPA], a dokozahexaén savat [DHA], a glutamint és anuklein savat) ne alkalmazzák rutinszerűen a MICU-ban.
- Ezeket a készítményeket csak TBI-ben szenvedő és perioperatív betegek esetében a SICU-ban alkalmazzák


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- **30. ajánlás:** Az omega-3-mal dúsított EN-formulát nagy dózisban nem szabad bolus adagolással beadni. Az ajánlás minősítése: B erős konszenzus (91%egyetértés)
- **31. ajánlás:** Az omega-3 FA-val dúsított EN táplálkozási dózisokban adagolható. Az ajánlás fokozata: 0 erős konszenzus (95%egyetértés)
- **32. ajánlás:** Magas dózisú, omega-3-mal dúsított enterális tápszereket nem szabad rutinszerűen adni. Az ajánlás fokozata: B konszenzus (90% egyetértés)


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- **26. ajánlás:** A testfelület több mint 20%-át érintő égési sérülések esetén az EN megkezdését követően 10–15 napig további enterális GLN-adagokat (0,3–0,5 g/kg/nap) kell beadni. Az ajánlás fokozata: B, erős konszenzus (95% egyetértés)
- **27. ajánlás:** Kritikus állapotú traumás betegeknél az EN-kezelés első öt napján további EN-adagokat (0,2–0,3 g/kg/nap) adhatnak GLN-ből. Elhúzódó sebgyógyulás esetén hosszabb, 10–15 napos időszakban is adható. Ajánlás fokozata: 0 erős konszenzus (91% egyetértés)
- **28. ajánlás:** Égési sérülések és traumás betegek kivételével az intenzív osztályon kezelt betegeknek nem szabad kiegészítő enterális GLN-t adni. Ajánlás fokozata: B erős konszenzus (92,31% egyetértés)

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- [illegible]

DOI: 10.1002/jpen.2267

CLINICAL GUIDELINES

Guidelines for the provision of nutrition support therapy in the adult critically ill patient: The American Society for Parenteral and Enteral Nutrition

Charlene Compher PhD, RD[1] | Angela L. Bingham PharmD[2,3] | Michele McCall MSc, RD[4] | Jayshil Patel MD[5] | Todd W. Rice MD, MSc[6] | Carol Braunschweig PhD[7] | Liam McKeever PhD, RDN[7]

TABLE 1 (Continued)

Guideline question 5A. In adult critically ill patients receiving PN, does provision of mixed-oil ILEs (ie, medium-chain triglycerides, olive oil, FO, mixtures of oils), as compared with 100% soybean-oil ILE, impact clinical outcomes?	**Evidence GRADE**: Low	**GRADE recommendation**: Because of limited statistically or clinically significant differences in key outcomes, we suggest that either mixed-oil ILE or 100% soybean-oil ILE be provided to critically ill patients who are appropriate candidates for initiation of PN, including within the first week of ICU admission.	**Strength of GRA recommendati**
Guideline question 5B. In adult critically ill patients receiving PN, does provision of FO-containing ILE, as compared with non–FO-containing ILE, impact clinical outcomes?	**Evidence GRADE**: Low	**GRADE recommendation**: Because there was only one outcome found with a significant difference that was not supported by data covering the other key downstream outcomes, we suggest that either FO- or non–FO-containing ILE be provided to critically ill patients who are appropriate candidates for initiation of PN, including within the first week of ICU admission.	**Strength of GRADE recommendation**: Weak

Discussion on clinical application questions 5A and 5B: In addition to 100% soybean-oil ILE, mixed oil– and FO-containing ILE products are now available in the United States, but health-system formulary availability of these formulations may vary. In general, ILE is a safe and effective energy source that can be included with the PN formulation at the time of initiation, including within the first week of ICU admission. Optimizing ILE provision helps avoid excessive dextrose provision and hyperglycemia. Monitoring serum triglyceride concentrations will give information about the adequacy of lipid clearance. The energy provided by lipid-based sedation should be considered in the overall estimate of lipid and energy intake. It is also important to give adequate levels of the essential fatty acids to meet requirements if the PN will be needed for >10 days. The essential fatty acid content of the mixed-oil ILE and FO-containing ILE is lower than that of the soybean-oil ILE.

Abbreviations: EN, enteral nutrition; FO, fish oil; GRADE, Grading of Recommendations, Assessment, Development, and Evaluation; ICU, intensive
ILE, lipid injectable emulsion; PN, parenteral nutrition; SPN, supplemental PN.

MIT…. Lipid, zsírsavak

- Zsírsavak kulcsszerepűek: sejtmembrán integritás, gén expresszió, szignál útvonalak, gyulladás, apoptózis, immunválasz stb.
- Linolénsavat és az α linolénsavat a szervezet nem képes felépíteni $\rightarrow$ zsírok is szükségesek
- Eltérő alkotójú és arányú kombinációk (szója-kókusz, szója-olíva, hal-szója, olíva-hal-szója)
- **Lipid:** zsíremulzió **0.7-1.5 g/kg/nap**
- Propofolt ne felejtsük
- Triglycerid !!! <12mmol/l (különben 72 óra zsírmentes)
- Parenterális lipid emulzó tartalmazzon EPA-t (eikozapentaénsav) + DHA-t (dokozahexaénsav), **halolaj dózis: 0.1-0.2 g/kg/nap**

Calder P.C. et al: Intensive Care Med 2010; 36: 735-49, Charrière M et al: Nutrition 2017; 42: 46-48.

ESPEN GL on clinical nutrition in the ICU: Clin Nutr 2018; 1-32

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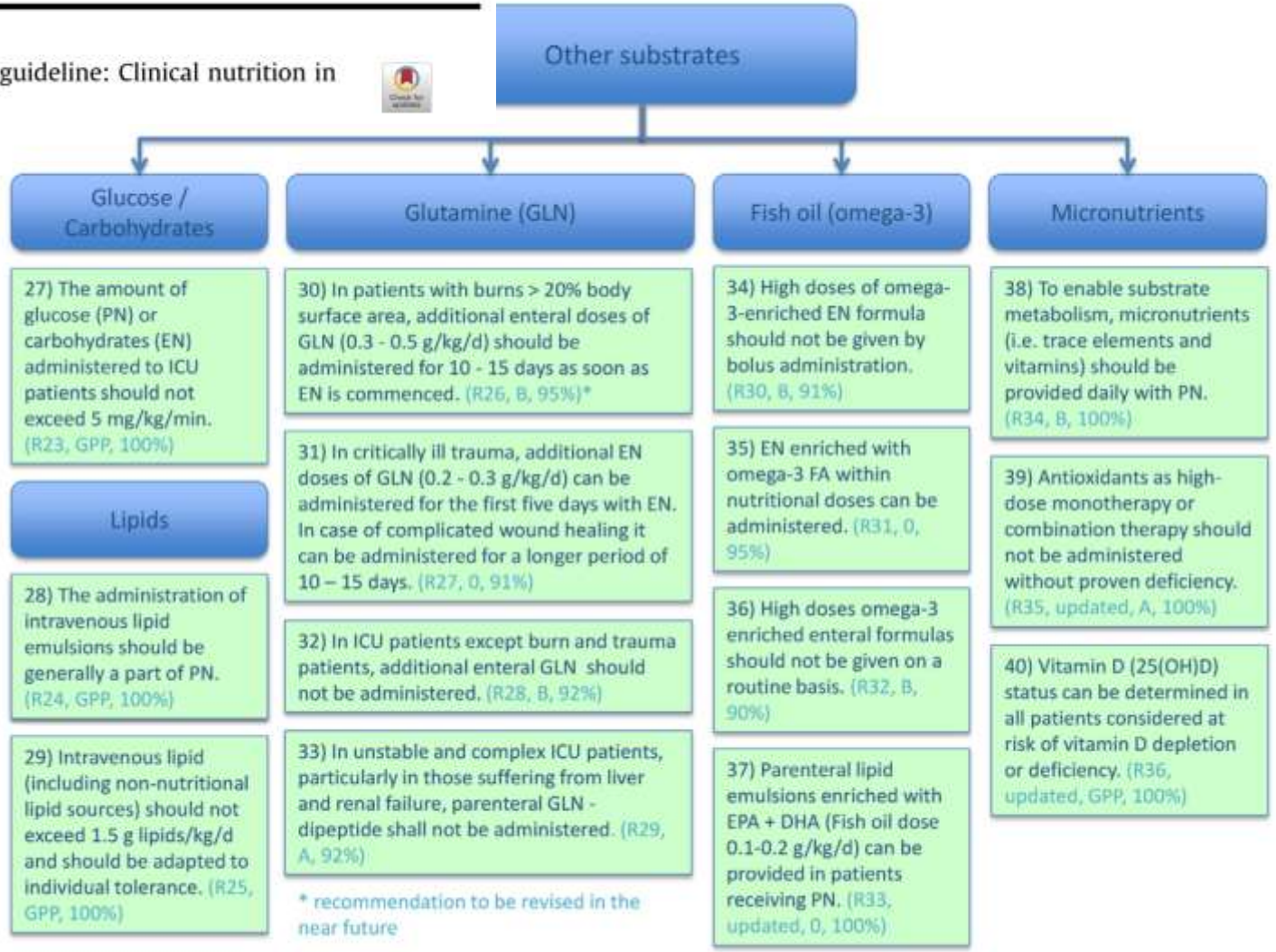
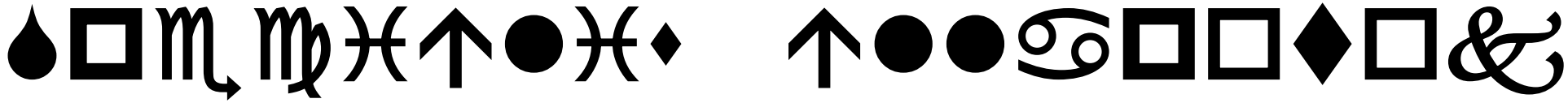


Fig. 6. Nutritional substrates other than protein needed for treatment of ICU patients.

PÉCSI TUDOMÁNYEGYETEM
Klinikai Központ
Aneszteziológiai és Intenzív Terápiás Intézet

Köszönöm a figyelmet



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I1. We suggest that specialty high-fat/low-carbohydrate formulations designed to manipulate the respiratory quotient and reduce CO_2 production not be used in ICU patients with acute respiratory failure (not to be confused with recommendation E3).

[Quality of Evidence: Very Low]

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J1. Based on expert consensus, we suggest that ICU patients with acute renal failure (ARF) or AKI be placed on a standard enteral formulation and that standard ICU recommendations for protein (1.2–2 g/kg actual body weight per day) and energy (25–30 kcal/kg/d) provision should be followed. If significant electrolyte abnormalities develop, a specialty formulation designed for renal failure (with appropriate electrolyte profile) may be considered.

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J2. We recommend that patients receiving frequent hemodialysis or CRRT receive increased protein, up to a maximum of 2.5 g/kg/d. Protein should not be restricted in patients with renal insufficiency as a means to avoid or delay initiating dialysis therapy.

[Quality of Evidence: Very Low]

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Journal of Parenteral and Enteral Nutrition
Volume 40 Number 2
February 2016 159–211

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K1. Based on expert consensus, we suggest a dry weight or usual weight be used instead of actual weight in predictive equations to determine energy and protein in patients with cirrhosis and hepatic failure, due to complications of ascites, intravascular volume depletion, edema, portal hypertension, and hypoalbuminemia. We suggest that nutrition regimens avoid restricting protein in patients with liver failure, using the same recommendations as for other critically ill patients (see section C4).

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K3. Based on expert consensus, we suggest that standard enteral formulations be used in ICU patients with acute and chronic liver disease. There is no evidence of further benefit of branched-chain amino acid (BCAA) formulations on coma grade in the ICU patient with encephalopathy who is already receiving first-line therapy with luminal-acting antibiotics and lactulose.

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M1b. We suggest that immune-modulating formulations containing arginine and FO be considered in patients with severe trauma.

[Quality of Evidence: Very Low]

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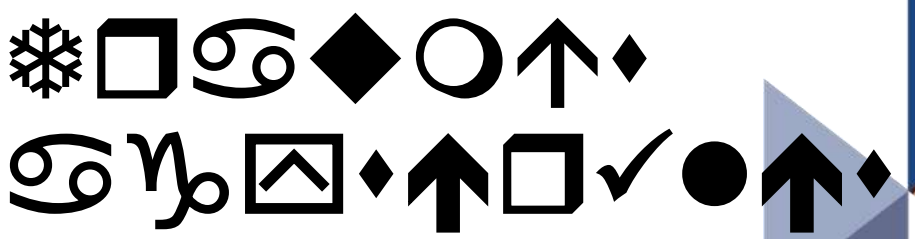

M2b. Based on expert consensus, we suggest the use of either arginine-containing immune-modulating formulations or EPA/DHA supplement with standard enteral formula in patients with TBI.

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M4c. Based on expert consensus, we suggest that patients with burn injury should receive protein in the range of 1.5–2 g/kg/d.

M4d. Based on expert consensus, we suggest very early initiation of EN (if possible, within 4–6 hours of injury) in a patient with burn injury.

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N4. Based on expert consensus, we suggest the provision of trophic feeding (defined as 10–20 kcal/h or up to 500 kcal/d) for the initial phase of sepsis, advancing as tolerated after 24–48 hours to >80% of target energy goal over the first week. We suggest delivery of 1.2–2 g protein/kg/d.

N5. We suggest that immune-modulating formulas not be used routinely in patients with severe sepsis.

[Quality of Evidence: Moderate]

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P1. Based on expert consensus, we suggest that chronically critically ill patients (defined as those with persistent organ dysfunction requiring ICU LOS >21 days) be managed with aggressive high-protein EN therapy and, when feasible, that a resistance exercise program be used.

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Q4. Based on expert consensus, we suggest that high-protein hypocaloric feeding be implemented in the care of obese ICU patients to preserve lean body mass, mobilize adipose stores, and minimize the metabolic complications of overfeeding.

Clinical Nutrition 42 (2023) 1671–1689

Contents lists available at ScienceDirect

Clinical Nutrition

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

ESPEN Guideline

ESPEN practical and partially revised guideline: Clinical nutrition in the intensive care unit

Recommendation 51

An iso-caloric high protein diet can be administered to obese patients, preferentially guided by indirect calorimetry measurements and urinary nitrogen losses.

Grade of recommendation: 0 – consensus (89% agreement)

Recommendation 52

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.

Grade of recommendation: GPP – consensus (89% agreement)

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Q5. Based on expert consensus, we suggest that, for all classes of obesity, the goal of the EN regimen should not exceed 65%–70% of target energy requirements as measured by IC. If IC is unavailable, we suggest using the weight-based equation 11–14 kcal/kg *actual body weight* per day for patients with BMI in the range of 30–50 and 22–25 kcal/kg *ideal body weight* per day for patients with BMI >50. We suggest that protein should be provided in a range from 2.0 g/kg ideal body weight per day for patients with BMI of 30–40 up to 2.5 g/kg ideal body weight per day for patients with BMI ≥40.

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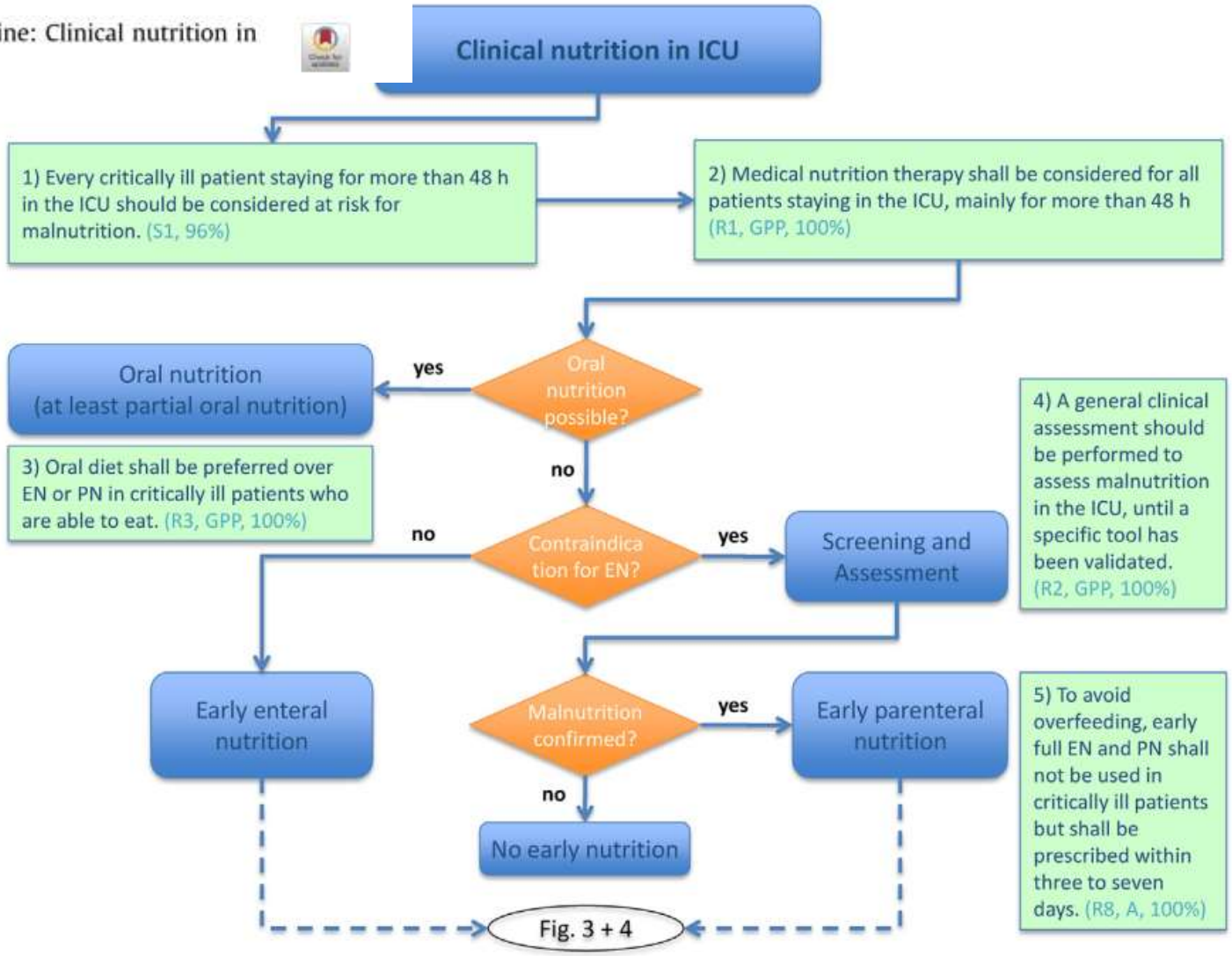

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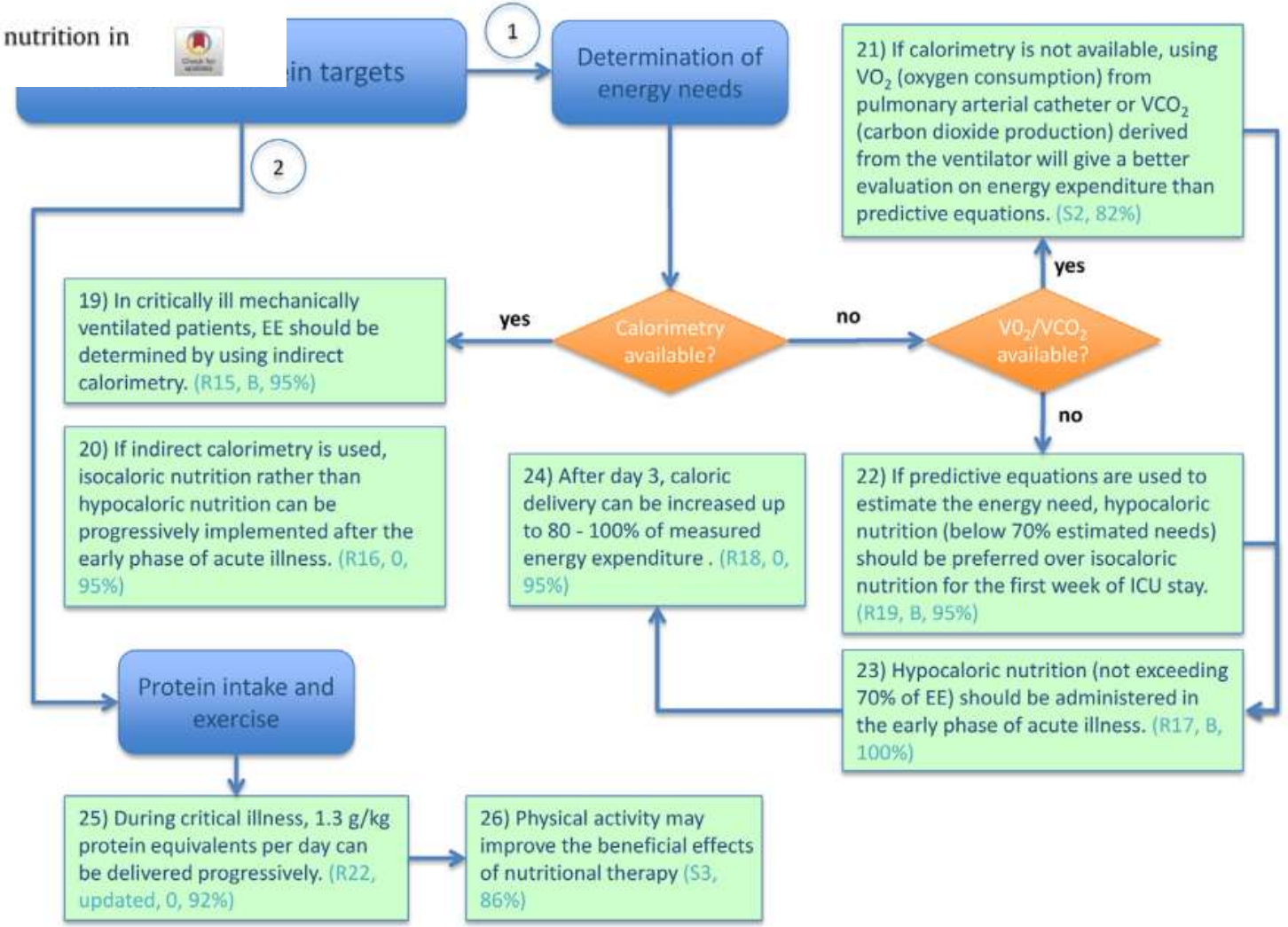
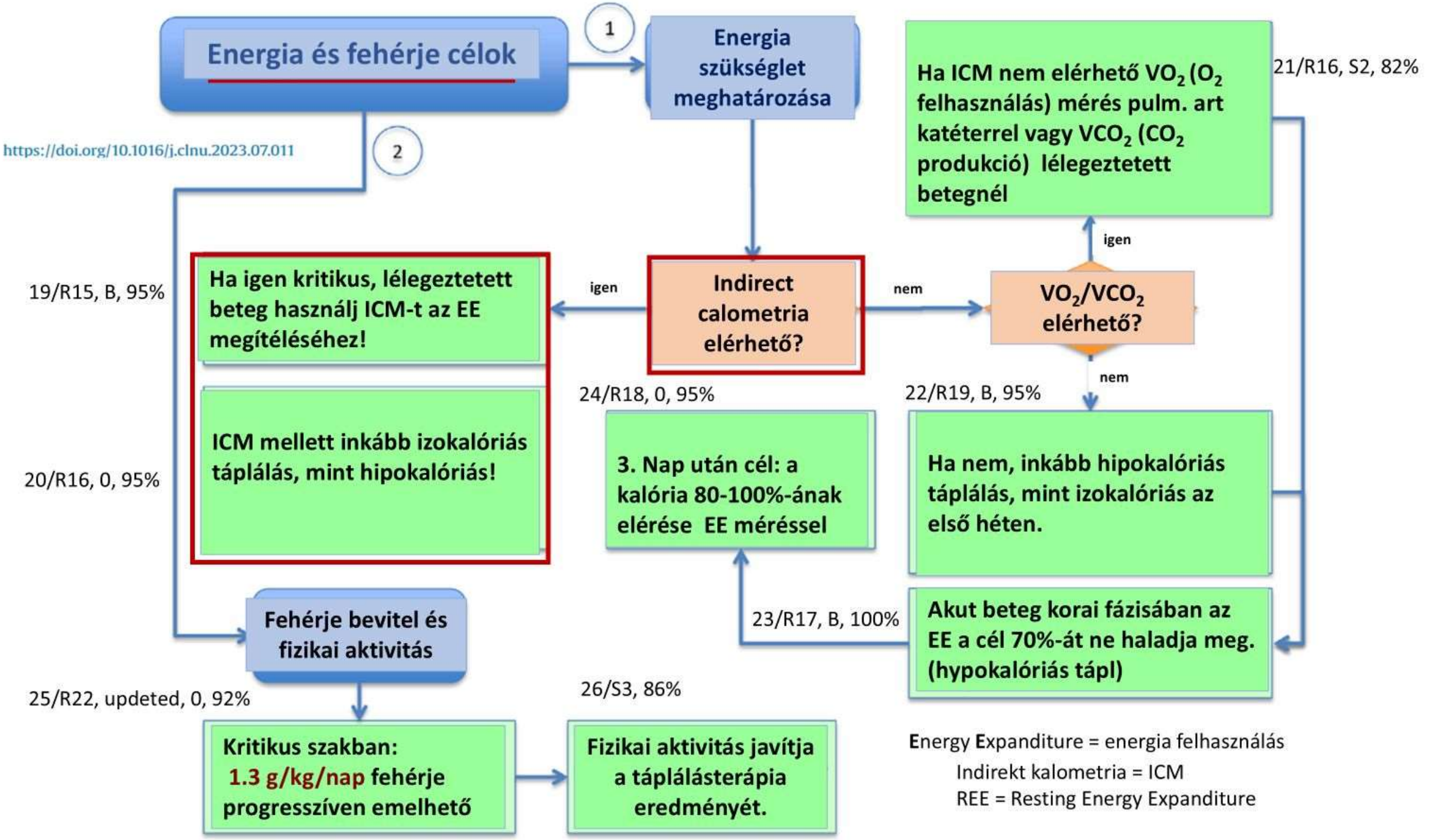
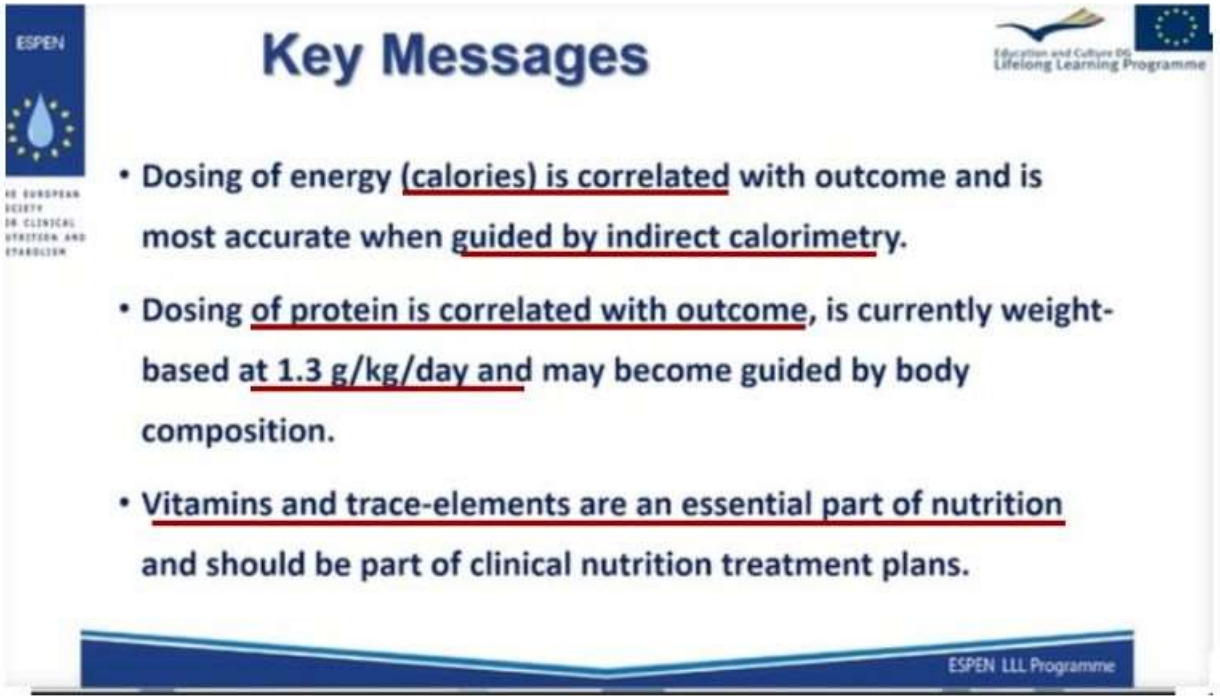



Energia és fehérje célok
1
Energia szükséglet meghatározása
2
https://doi.org/10.1016/j.clnu.2023.07.011
Ha ICM nem elérhető VO_2 (O_2 felhasználás) mérés pulm. art katéterrel vagy VCO_2 (CO_2 produkció) lélegeztetett betegnél
21/R16, S2, 82%
igen
Indirect calometria elérhető?
igen
nem
VO_2/VCO_2 elérhető?
nem
19/R15, B, 95%
Ha igen kritikus, lélegeztetett beteg használj ICM-t az EE megítéléséhez!
ICM mellett inkább izokalóriás táplálás, mint hipokalóriás!
20/R16, 0, 95%
24/R18, 0, 95%
3. Nap után cél: a kalória 80-100%-ának elérése EE méréssel
22/R19, B, 95%
Ha nem, inkább hipokalóriás táplálás, mint izokalóriás az első héten.
23/R17, B, 100%
Akut beteg korai fázisában az EE a cél 70%-át ne haladja meg. (hypokalóriás tápl)
Fehérje bevitel és fizikai aktivitás
25/R22, updeted, 0, 92%
26/S3, 86%
Kritikus szakban: 1.3 g/kg/nap fehérje progresszíven emelhető
Fizikai aktivitás javítja a táplálásterápia eredményét.
Energy Expanditure = energia felhasználás
Indirekt kalometria = ICM
REE = Resting Energy Expanditure

Szakértői csoport



- Fontos a **PICS** megelőzés, kezelés az ITO tartózkodás alatt **testmozgás, pszichológia és család** támogatásával. A **táplálás ennek része**.
- A korai mobilizációt táplálásterápiával kell kombinálni – **korán kell elkezdeni** és **lassan felépíteni**.
- Mind a kalória-, mind a fehérjebevitel összefügg a betegek kimenetelével.
- Az **indirekt kalorimetria (ICM)** a legmegfelelőbb és legpontosabb módszer.
- Magas fehérjebevitel és a korai mobilizáció jobb eredményű (szignifikáns előny a mortalitásban).
- **EFFORT tanulmány** nincs különbség a magas és alacsony fehérjetartalmú PN között. ESPEN javasolta **1,3 g/kg/nap** helyes
- **Akut** fázisban kevesebb fehérje (autofágia) – ezért a fehérje dózist **fokozatosan** kell növelni.
- A **kiegészítő PN a 4. naptól** továbbra is indikált.