Parenteral Nutrition

G. When to Use PN

patient at low nutrition risk

- We suggest that, in the patient **at low nutrition risk** (eg, NRS 2002 ≤3 or NUTRIC score ≤5), exclusive PN be withheld over the first 7 days following ICU admission if the patient cannot maintain volitional intake and if early EN is not feasible.

- Patients who have a diagnosis that makes them **PN dependent (**eg, short bowel) should continue their PN upon admission to the ICU unless bacteremia is suspected

patient at high nutrition risk?

- G2.in the patient determined to be at high nutrition risk (eg, **NRS 2002 ≥5 or NUTRIC score ≥5**) or severely malnourished, when EN is not feasible, we suggest initiating exclusive PN **as soon as possible** following ICU admission.

optimal timing for initiating supplemental PN

in patients at **<u>either low or high nutrition risk</u>**:

- use of supplemental PN be considered after 7–10 days if unable to meet >60% of energy and protein requirements by the enteral route alone.
- Initiating supplemental PN prior to this 7- to 10-day period in critically ill patients on some EN **does not improve** outcomes and may be **detrimental** to the patient

H. When Indicated, Maximize Efficacy of PN

strategies to improve PN efficacy

- the use of protocols and nutrition support teams to help incorporate strategies to maximize efficacy and reduce associated risk of PN.

Management of PN should include attention to:

- rate of advancement of feeding
- glycemic control
- electrolyte monitoring
- and repletion (evidence of refeeding)
- duration of PN
- and transition to EN as feasible.

- Attention to refeeding syndrome is especially important for the patient with risk factors:
- alcoholism
- weight loss
- low body mass index [BMI]
- prolonged periods NPO.

- Although refeeding syndrome can occur with EN, the risk is higher with initiation of PN.

- In those patients, advancement of feeding should be slower, taking 3–4 days to reach goal. Use of protocols and nutrition support teams have been shown to decrease PN-associated complications

- Question: In the appropriate candidate for PN (high risk or severely malnourished), should the dose be adjusted over the first week of hospitalization in the ICU?

- H2. We suggest that hypocaloric PN dosing (≤20 kcal/ kg/d or 80% of estimated energy needs) with adequate protein (≥1.2 g protein/kg/d) be considered in appropriate patients (high risk or severely malnourished) requiring PN, initially over the first week of hospitalization in the ICU.

- **soy-based IV fat** emulsions (IVFEs) in the first week VS

alternative IVFEs (ie, medium-chain triglycerides [MCTs], olive oil [OO], FO, mixture of oils) ?

We suggest withholding or limiting SO-based IVFE during the first week following initiation of PN in the critically ill patient to a maximum of 100 g/wk (often divided into 2 doses/wk) if there is concern for essential fatty acid deficiency.

- H3b. Alternative (SMOF [soybean oil, MCT, olive oil, and fish oil emulsion], MCT, OO, and FO) IVFEs may provide outcome benefit over soy-based IVFEs

- Question: Is there an advantage to using standardized commercially available PN (premixed PN) versus compounded PN admixtures?

- H4. Based on expert consensus, use of standardized commercially available PN versus compounded PN admixtures in the ICU patient **has no advantage in terms of clinical outcomes.**

The desired target blood glucose range in adult ICU patients

- H5. We recommend a target blood glucose range of **140 or 150–180** mg/dL for the **general ICU population**; ranges for specific patient populations (postcardiovascular surgery, head trauma) may differ and are beyond the scope of this guideline.

- **For specific patient populations (eg, postcardiovascular surgery, head trauma), we defer to SCCM published guidelines on glycemic control.**

- We suggest that a **BG ≥ 150 mg/dL triggers initiation of insulin** therapy for most patients admitted to an ICU with the diagnoses of ischemic stroke, **intraparenchymal hemorrhage**, aneurysmal subarachnoid hemorrhage, or **TBI**.

- titrated to achieve BG values absolutely < 180 mg/dL with minimal BG excursions <**100** mg/dL, to minimize the adverse effects of hyperglycemia.

- Hypoglycemia carries specific risks for the normal brain and a greater risk for the injured brain .
- Severe hypoglycemia (SH) can produce or **exacerbate:**

focal neurological deficits,

encephalopathy,

seizures or status epilepticus,

permanent cognitive dysfunction,

and death.

- Further, tight GC may induce regional neuroglycopenia in **TBI**

- Question: Should parenteral glutamine be used in the adult ICU patient?
- H6. We recommend that parenteral glutamine supplementation not be used routinely in the critical care setting.

Guideline question 3.

In adult critically ill patients who are candidates for EN, does similar energy intake by PN vs EN as the primary feeding modality in the first week of critical illness impact clinical outcomes?

- Evidence GRADE: High
- recommendation: Strong

There was no significant difference in clinical outcomes. Because similar energy intake provided as PN is not superior to EN and no differences in harm were identified, we recommend that either PN or EN is acceptable

Discussion on clinical application for question 3

- Our findings indicate that when similar energy is delivered by PN or EN early in critical illness for relatively short periods of time, clinical outcomes are similar. Given these data, cost and convenience of providing EN vs PN may be larger determinants of route of feeding early in critical illness than differences in clinical outcomes.

- The two reported trials gave∼18–20 kcal/kg/day and 0.6–0.8 g/kg/day protein, and both used a premixed PN solution.

- Avoidance of energy overfeeding may be the most important decision to make regarding PN use.
- Optimal glycemic control and catheter care are also important factors in the provision of PN to reduce infectious complications.
- Clinical judgment about an individual patient’s metabolic tolerance to the dextrose (monitor glycemic control), ILE (monitor serum triglyceride concentrations), and amino acid dose is key to delivery of appropriate PN feedings.

Guideline question 4

In adult critically ill patients receiving EN, does provision of SPN, as compared with no SPN during the first week of critical illness, impact clinical outcomes?

- Evidence GRADE: High
- recommendation: Strong

- In adult critically ill patients receiving EN, does provision of SPN, as compared with no SPN during the first week of critical illness, impact clinical outcomes?

Discussion on clinical application for question 4

- The data in this guideline compared SPN within the first week of ICU care and excluded patients with malnutrition.

- These findings imply that the average critically ill patient will not be harmed by waiting a week to initiate SPN.

Discussion on clinical application for question 4

- Further, the patient’s tolerance to EN may improve in that time window.
- However, the needs of malnourished patients or patients who have limited lean muscle mass were not included in these trials and may differ from those of nonmalnourished patients.

- Patient-specific clinical judgment should be used regarding theinitiation of SPN in the first 7 days for these special cases.

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
- recommendation: Weak

- 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.

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
- recommendation: Weak

- recommendation: 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

Discussion on clinical application questions 5A and 5B

- 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.

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 e strong consensus (100% agreement)

Recommendation 6

In case of contraindications to oral and EN, PN should be implemented **within three to seven days**

Grade of recommendation: B econsensus (89% agreement)

Recommendation 7

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

Recommendation 20

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.

Recommendation 21

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

Recommendation 25

Intravenous lipid (including non-nutritional lipid sources) should not exceed 1.5 g lipids/kg/day and should be adapted to individual tolerance

Recommendation 23

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

Recommendation 33

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

Recommendation 35

Antioxidants as high dose monotherapy should not be administered without proven deficiency.

Recommendation 36

In critically ill patients with measured low plasma levels (25-hydroxy-vitamin D < 12.5 ng/ml, or 50 nmol/l) vitamin D3 can be supplemented.

ترکیبات محلولهای تغذیه وریدی

- **درشت مغذی ها**
  - ✓پروتئین
  - ✓امولسیون چربی
  - ✓دکستروز
- **ریز مغذی ها**
  - ✓ویتامین ها
  - ✓عناصر کمیاب
  - ✓الکترولیت ها

درشت مغذی ها
آمینواسیدها

- پروتئین به شکل آمینواسید های کریستالی

- ۱گرم آمینواسید ۴ کیلوکالری

پروتئین به عنوان منبع انرژی؟!

انواع آمینواسیدها

- محلولهای آمینواسید استاندارد

✓مناسب افراد دارای عملکرد ارگانی نرمال

- محلول های آمینواسید اصلاح شده

✓مناسب بیماران با نیازهای تغییر یافته به پروتئین

محلولهای آمینواسید استاندارد

- حاوی آمینواسیدهای ضروری–غیرضروری– نیمه ضروری

✓در غلظت های ۵٪ – ۱۰٪ – ۲۰٪
✓حاوی ۱۹ تا ۲۵ ٪ اسیدهای آمینه شاخه دار
✓درحجم ۵۰۰ سی سی

ملاحظات در مورد محلول های آمینواسید

دارا بودن الکترولیت ها

- ✓حاوی الکترولیت محصول شرکت B-Brun
- ✓بدون الکترولیت محصول شرکت B-Brun و شرکت Fresinius kabi

Aminoplasmal 5, 10%

	5%	10%
Total amino acids	50g/l	100 g/l
Total nitrogen	8g/l	16.0 g/l
Caloric value(kcal/l)	200	400
Osmolarity	440mOsm/l	885 mOsm/l

- No Taurine
- Include electrolytes
- Contraindicated in new-borns or infants up to completed 2nd year
- *Electrolyte concentrations (mmol/l):*
  Sodium 50, K 25, Mg 2.5, Acetate 35, Cl 45, P 10, Citrate 2

Aminoven 5, 10%

	5%	10%
Total amino acids	50g/l	100 g/l
Total nitrogen	8g/l	16.0 g/l
Caloric value(kcal/l)	200	400
Osmolarity	495mOsm/l	990 mOsm/l

- **Taurine**, **No electrolytes**
- The administration of Aminoven is contraindicated in neonates.
- No clinical studies in newborns, infants and children

Aminoven Infant 10%

درشت مغذی ها

دکستروز

- منبع اصلی انرژی درتغذیه وریدی
- ۱ گرم دکستروز حاوی ۳.۴ کیلوکالری انرژی

✓Serum 1/3 2/3 . 1 lit>>> 30 gr dextrose

✓Serum dextrose water 5% (D/W 5%) 1 lit >>> 50 gr dextrose

✓Serum dextrose saline (D/S) 1 lit >>> 50 gr D and saline

✓Serum dextrose water 10% (D/W 10%) 1 lit >>> 100 gr dextrose

✓Vial dextrose water 20% (D/W 20%) 50 cc >>> 10 gr dextrose

✓Vial dextrose water 50% (D/W 50%) 50 cc >>> 25 gr dextrose

لیپید

- منبع انرژی
- منبع اسیدهای چرب ضروری
- حاوی فسفولیپیدهای تخم مرغ>>> امولسیون کننده
- حاوی گلیسرول >>> ایزوتون کردن امولسیون

لیپید

- انرژی هرمیلی لیتر امولسیون
- ۱۰٪ ۱/۱ حاوی کیلوکالری
- ۲۰٪ حاوی ۲ کیلوکالری
- ۳۰٪ حاوی ۳ کیلوکالری

ملاحظات در مورد امولسیون های چربی

- پروپوفول >>> داروی بیهوشی

✓حاوی LCT از روغن سویا

✓معادل اینترالیپید ۱۰٪

SMOFlipid® 20 %

- Active ingredients/l:
  - Soya-bean oil, 60.0 g
  - MCT 60.0 g
  - Olive oil 50.0 g
  - Fish oil 30.0 g.
- Total energy: 2000kcal/l.
- Osmolality: Approx. 380 mosm/kg

ریز مغذی ها

Glycophos

Glycophos must not be given undiluted.

- Adults:

The recommended dosage is individual. The recommended daily dosage of phosphate during intravenous nutrition would normally be 10-20 mmol. This can be met by using **10-20 ml** of Glycophos added to the infusion solution or to the admixture for which compatibility has been proved.

- Infants:

The recommended dosage is individual. The recommended dose for infants and neonates is **1.0-1.5 mmol/Kg body weight/day.**

Glycophos

- Contra-indications

Glycophos should not be given to patients in a state of dehydration or with hypernatraemia, hyperphosphataemia, severe renal insufficiency or shock.

Calcium Gluconate

- **Usual Adult Dose for Hypocalcemia**

Intravenous:

- 500 to 2000 mg (5 to 20 mL) IV one time at a rate not to exceed 0.5 to 2 mL/min.
- The dose may be increased as needed.
- The usual daily dosage ranges from 1000 to 15,000 mg (10 to 150 mL) in divided doses or as a continuous infusion. Doses may be repeated every 1 to 3 days as needed and tolerated to normalize the serum calcium level.

Requirements of Trace Elements

Trace elements	Requirement/day (adult)
Zn (mg)	2.5-4.0
Cr (μg)	10-15
Cu (mg)	0.3-0.5
Mn (μg)	60-100
Fe (mg)	1.0-2.0
I (μg/kg)	1.0-2.0
Mo (μg)	20-130
Se (μg)	20-40

Tracutil

Contains:

- Iron 2mg
- Zinc 3.3
- Manganese 0.55mg
- Copper 0.76
- Chromium 10mcg
- Molybden 10mcg
- Selenium 24mcg
- Fluoride 570mcg
- Iodine 127 mcg

Addamel N

Contains:

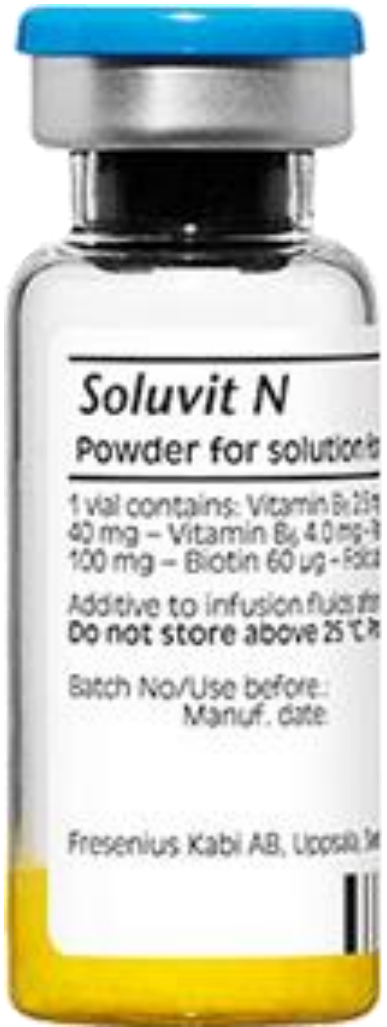
- Iron
- Zinc
- Manganese
- Copper
- Chromium
- Sodium molybdate
- Sodium selenite
- Sodium fluoride
- Potassium iodide

Vitamin requirements

Vitamin	Amount
Thiamine B1	6 mg (3)
Riboflavin B2	3.6 mg
Pyridoxine B6	6 mg (4)
Cyanocobalamin B12	5 µg
Niacin	40 mg
Folic acid	600 µg (400)
Pantothenic acid	15 mg
Biotin	60 µg
Ascorbic acid	200 mg (100)
Vit. A	3300 IU
Vit. D	5 µg
Vit. E	10 IU
Vit. K	150 µg

Soluvit N

- Infusion concentrate of water soluble vitamins
  - Vitamin B1 2.5 mg
  - Vitamin B2 3.6 mg
  - Nicotinamide 40 mg
  - Vitamin B6 4.0 mg
  - Pantothenic acid 15.0 mg
  - Vitamin C 100 mg
  - Biotin 60 µg
  - Folic acid 0.4 mg
  - Cyanocobalamin 5.0 µg



تغذیه وریدی ترکیبی

- ترکیب ۳ در ۱ TNA یا 3 in 1
- ترکیب ۲ در ۱ و امولسیون چربی جدا 2 in 1
- محلول های ترکیبی در اتاق تمیز

NuTRIflex® Lipid – Bag design

Filling ports

Glucose
and electrolytes

Lipids:
MCT/ LCT

Hanger

Peel seals

Amino acids
and electrolytes

Infusion port

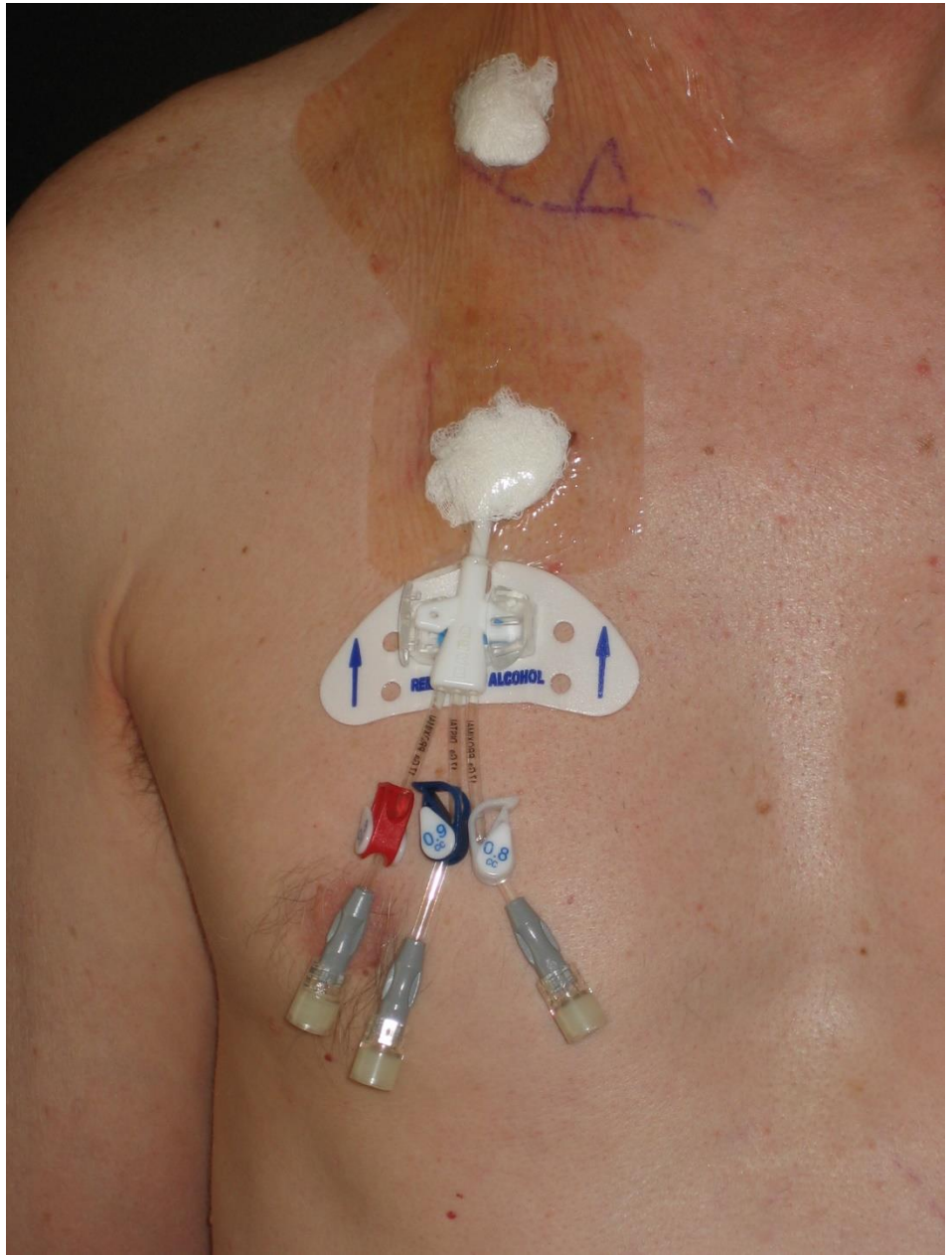
Additives port

اتاق تمیز

اتاق تمیز

CV Line

CV Line



حل کیس head trauma

مردی ۲۵ ساله با قد ۱۷۱ سانتی متر و وزن ۷۱ کیلوگرم . با وضعیت بالینی نرمال

تشخیص SAH –Base skull fracture – GCS=7

بیمار Intube می باشد و لوله نازوگاستریک تعبیه شده

بیمار از تاریخ ۳ تیر تا تاریخ ۱۰ تیر روزانه بیش از ۳۵۰ سی سی در روز تحمل تغذیه انترال نداشته. در تاریخ ۱۰ تیر درخواست مشاوره تغذیه شده.

ارزیابی تغذیه ای

- ارزیابی آنتروپومتریک

قد ۱۸۴سانتی متر

وزن ۷۵ کیلوگرم

با کاهش وزن از زمان بستری حدود ۱۰کیلوگرم

ارزیابی بیوشیمیایی

Albumin= ۲/۲

SGOT=۱۸۹

SGPT= ۷۳

TG= ۹۷

Total bilirubin= ۰/۴

Direct bilirubin= ۰/۱

P= ۴/۱

Na= ۱۴۳

K=۱/۴

BS= ۹۹

creatinine= ۱/۱

BUN=۱۴

حل کیس پرانترال دیابتی

- بیمار آقای ۷۴ ساله مورد diabetic foot و آمپوتاسیون پای چپ از بالای زانو که بعد از جراحی افت GCSداشته اند و گاواژ تحمل نمیکنند. ۴ روز از زمان بستری گذشته و تابحال دریافت تغذیه ای نداشته اند. لطفا TPNتنظیم شود.
- بیمار روزانه پروتکل انسولین میگیرند.

ارزیابی تغذیه ای

- ارزیابی آنتروپومتریک

قد ۱۷۳سانتی متر

وزن ۷۰ کیلوگرم

ارزیابی بیوشیمیایی

Albumin= ۲/۲

SGOT=۱۷

SGPT= ۷۹

TG= ۱۳۵

Total bilirubin= ۰/۴

Direct bilirubin= ۰/۱

P= ۱/۶

Na= ۱۴۰

K=۳/۵

BS= ۲۱۲

creatinine= ۱/۱

BUN=۱۵

حل کیس پرانترال جراحی

- بیمار آقای ۴۲ ساله مورد مینی بای پس معده قبلی حدود یک سال پیش. در حال حاضر با بی اشتهایی، تهوع، استفراغ شدید بستری شده اند و NPO هستند. سنگ صفراوی و انسداد روده ای تشخیص گذاشته شده. لطفا TPN بیمار تنظیم شود.

ارزیابی تغذیه ای

- ارزیابی آنتروپومتریک

قد ۱۴۵سانتی متر

وزن ۱۲۰ کیلوگرم

بیمار کاشکتیک است.

ارزیابی بیوشیمیایی

Albumin= ۱/۴

SGOT=۱۷۶

SGPT= ۱۴۳

TG= ۱۷۸

Total bilirubin= ۰/۴

Direct bilirubin= ۰/۱

P= ۱/۶

Na= ۱۴۰

K=۳/۵

BS= ۶۵

creatinine= ۰/۴

BUN=۱۰