

4. A 88yo, 154 lb, 5' 4" female is admitted for intestinal obstruction. She is to be placed on TPN until the her gut starts working again. Labs are:

sodium	136 mEq/L	normal range 135 – 150 mEq/L
potassium	2.9 mEq/L	normal range 3.5 – 5.0 mEq/L
chloride	97 mEq/L	normal range 100 – 106 mEq/L
bicarbonate	29 mEq/L	normal range 24 – 30 mEq/L
BUN	70 mg/dL	normal range 8 – 20 mg/dL
creatinine	1.7 mg/dL	normal range 0.6 – 1.2 mg/dL
glucose	117 mg/dL	normal range 70 – 110 mg/dL, fasting
calcium	8.8 mEq/L	normal range 8.5 – 10 mEq/L
phosphate	3.8 mg/dL	normal range 2.6 – 4.5 mg/dL
magnesium	2.6 mEq/L	normal range 1.8 – 2.5 mEq/L
albumin	2.7 g/dL	normal range 3.5 – 5 g/dL (long-term nutritional status)

Calculate her nutritional needs using both the pre-set volume and the pump methods.

A note: the serum creatinine in this patient would normally indicate kidneys that are not working well (calculated creatinine clearance around 20 ml/min) and so volume restriction might normally be considered. However, in patients who are volume depleted (i.e., low blood volume in their vascular system), the BUN and creatinine will both be elevated and the BUN will elevate faster than the creatinine. A BUN:creatinine ratio of greater than 20 is a hallmark of volume depletion. This woman's BUN:creatinine ratio is 70:1.7 or 41:1 and so she is definitely volume depleted. Once her intravascular volume is restored, her serum creatinine will drop and her kidney function will appear more normal. Bear in mind, however, that kidney function tends to decrease with increasing age, so this 88 year old woman is unlikely to have "normal" kidney function and thus her volume status (weight, urine output, blood pressure, edema, crackles in the lung) will need to be checked carefully every day.

**Analysis of patient situation:**

- **She is hospitalized, weak, and dehydrated (although this will be fixed by the time the TPN is started), but otherwise unstressed, so probably needs no or low (1.1) stress adjustment.**
- **Her ABW = 70 kg and IBW = 54 kg, so a feed weight could be anything from 54 – 64 kg. Many pharmacists would probably go for something in between, but anything within this range is quite acceptable.**
- **Her albumin is low so her corrected calcium will appear fairly high. Assuming this decreases somewhat once she is hydrated, you will still want to go on the mid to low end of the calcium dosing guideline.**
- **Her chloride is low and her bicarb is in the upper part of the normal range, so she is not acidotic. You will not need to give her sodium as the acetate salt.**

**TPN Worksheet using pre-set volumes**

age: 88 sex: F

height: 163 cm

ABW: 70 kg

IBW: 54 kg

feed weight: 55 kg

*no reason to go higher than this*

**Targets:**

**1. Daily fluid needs.**

>20 kg: 1500ml + (20 ml)(W - 20 kg) 2060

30 - 35 ml/kg/day 1650 - 1925

calculated target: 1650 - 2200 ml/day

**2. Protein requirements.**

normal, unstressed individual: 0.8g/kg/day

hospitalized patient: 1-1.2g/kg/day

stressed patient: 1.5-2g/kg/day

calculated target: 55 - 66 g protein/day

**3. Non-protein calories**

$BEE_{men} = 66.67 + 13.75(W) + 5.0(H) - 6.76(A)$

calculated target: 1400 kcals/day

$BEE_{women} = 665.1 + 9.56(W) + 1.86(H) - 4.68(A)$  1082

activity factors: confined to bed: 1.2, out of bed: 1.3

stress factors: surgery: 1.2; infection: 1.4; trauma: 1.5; burns: 1.7 1.0 - 1.1

TDE = (BEE) (activity factor) (stress factor) (1082)(1.2)(1.0 - 1.1) = 1298 - 1429 kcals/day

**Amounts:**

**4. Total TPN volume** 1700 ml/day; volume for each TPN: 1000 ml/bag; # bags/day: 1.7

*she will be repleted intravascularly and will get 500ml lipid daily, so will stay at low end of fluid target*

**5. Protein Volume** choose one:

27.5g in 500ml 5.5% AA

42.5g in 500ml 8.5% AA

50g in 500ml 10% AA or

46.75 g/day: 0.84 g/kg/day

72.2 g/day - 1.3 g/kg/day - reasonable target

0.8 g/kg/day only OK if bad kidneys

10% AA calculated volume: \_\_\_\_\_ ml

**6. Dextrose volume** (3.4 kcals/g) choose one

3.5 mg/kg/min = 217 g/day = 163 g/bag

100g in D20W 500ml

250g in D50W 500ml

350g in D70W 500ml or

*have to do 20% since 50% would be too high. (100 g/bag)(1.7 bags/day)(3.4 kcals/g) = 578 kcals CHO*

D70W calculated volume: \_\_\_\_\_ ml 1400 kcals - 578 kcals CHO = 822 kcals to give as fat

**7. Fat volume** (9 kcals/g) choose one:

550kcals/500ml 10% lipid

900kcals/ 500ml of 20% lipid

or

20% lipid calculated volume: \_\_\_\_\_ ml

plus sterile water volume: \_\_\_\_\_ ml

**Electrolytes:**

**8. Daily electrolyte needs** total amt of kcals/day from fat and dextrose:  $578 + 900 = 1478$  kcals (61% fat)

	<u>amt/1000 calories</u>	<u>(amt)(# daily cal)/1000</u>		<u>amount/bag</u>
sodium	40-50 mEq	<u>59 - 74</u>	<i>divide</i>	<u>40</u> mEq
potassium	40mEq	<u>59</u>	<i>each</i>	<u>35</u> mEq
magnesium	8-12mEq	<u>12 - 17</u> by 1.7		<u>8</u> mEq
calcium	2-5 mEq	<u>3 - 7</u>	<i>to get</i>	<u>2</u> mEq
phosphate	15-25mMol	<u>22 - 37</u>	<i>amt/bag</i>	<u>18</u> mMol

*chalk test: (18)(2) + 2 = 38 so OK*

**9. Calculate the volume of each electrolyte solution that you will add**

sodium chloride 23.4% (4mEq/ml)

volume to add

10.0 ml

sodium acetate 16.4% (2mEq/ml)

0.0 ml

potassium phosphate: 3mMol phosphate/ml, 4.4 mEq potassium/ml

6.0 ml

potassium chloride 2mEq/ml

4.3 ml

magnesium sulfate 4mEq/ml

2.0 ml

calcium gluconate 10% (0.465mEq/ml)

4.3 ml

**infusion rate:** 71 ml/hr  $1700 \text{ ml} \div 24 \text{ hrs} = 71 \text{ ml/hr}$

**TPN Worksheet using pump**age: 88 sex: Fheight: 163 cmABW: 70 kgIBW: 54 kgfeed weight: 55 kg*no reason to go higher than this***Targets:****2. Daily fluid needs.**

&gt;20 kg: 1500ml + (20 ml)(W - 20 kg) 2060

calculated target: 1650 – 2200 ml/day

30 - 35 ml/kg/day 1650 - 1925

**2. Protein requirements.**

normal, unstressed individual: 0.8g/kg/day

calculated target: 60 g protein/dayhospitalized patient: 1-1.2g/kg/day 55 – 66 g/day

stressed patient: 1.5-2g/kg/day

**3. Non-protein calories** $BEE_{men} = 66.67 + 13.75(W) + 5.0(H) - 6.76(A)$ calculated target: 1400 kcals/day $BEE_{women} = 665.1 + 9.56(W) + 1.86(H) - 4.68(A)$  1082activity factors: confined to bed: 1.2, out of bed: 1.3

stress factors: surgery: 1.2; infection: 1.4; trauma: 1.5; burns: 1.7 1.0 – 1.1

TDE = (BEE) (activity factor) (stress factor) (1082)(1.2)(1.0 – 1.1) = 1298 - 1429 kcals/day

**Amounts:****4. Total TPN volume** 1700 ml/day; volume for each TPN: 1700 ml/bag; # bags/day: 1**5. Protein Volume** choose one:

27.5g in 500ml 5.5% AA

42.5g in 500ml 8.5% AA

50g in 500ml 10% AA or

10% AA calculated volume: 600 ml $(60 \text{ g/day})(100 \text{ ml}/10 \text{ g}) = 600 \text{ ml}$ **6. Dextrose volume** (3.4 kcals/g) choose one3.5 mg/kg/min = 277 g/day

100g in D20W 500ml

250g in D50W 500ml

350g in D70W 500ml or

D70W calculated volume: 400 ml $(277 \text{ g/day})(100 \text{ ml}/70 \text{ g}) = 395.7 \approx 400 \text{ ml}$  $(400 \text{ ml})(70 \text{ g}/100 \text{ ml})(3.4 \text{ kcals/g}) = 952 \text{ kcals from CHO}$ **7. Fat volume** (9 kcals/g) choose one: $1400 \text{ kcals} - 952 \text{ CHO kcals} = 448 \text{ kcals to give as fat}$ 

550kcals/500ml 10% lipid

900kcals/ 500ml of 20% lipid or

 $(448 \text{ kcals fat})(1 \text{ g fat}/9 \text{ kcals})(100 \text{ ml}/20 \text{ g fat}) = 248 \text{ ml} \approx 250 \text{ ml } 20\% \text{ fat}$ 20% lipid calculated volume: 250 ml plus sterile water volume: 400 ml $1700 \text{ ml} - 600 \text{ ml AA} - 400 \text{ ml CHO} - 250 \text{ ml fat} - 50 \text{ ml lytes} = 400 \text{ ml as water}$ **Electrolytes:****8. Daily electrolyte needs** amt of kcals/day from fat and dextrose:  $952 + 450 = 1400 \text{ kcals}$  (32% fat)

	<u>amt/1000 calories</u>	<u>(amt)(# daily cals)/1000</u>	<u>amount/bag</u>	
sodium	40-50 mEq	<u>59 – 74</u>	<u>64</u>	mEq
potassium	40mEq	<u>59</u>	<u>59</u>	mEq
magnesium	8-12mEq	<u>12 – 17</u>	<u>16</u>	mEq
calcium	2-5 mEq	<u>3 – 7</u>	<u>4.65</u>	mEq
phosphate	15-25mMol	<u>22 – 37</u>	<u>30</u>	mMol

*chalk test: (30)(2) + 5 = 65 ÷ 1.7 ≈ 38/L so OK***9. Calculate the volume of each electrolyte solution that you will add**

		<u>volume to add</u>	
sodium chloride	23.4% (4mEq/ml)	<u>16.0</u>	ml
sodium acetate	16.4% (2mEq/ml)	<u>0.0</u>	ml
potassium phosphate:	3mMol phosphate/ml, 4.4 mEq potassium/ml	<u>10.0</u>	ml
potassium chloride	2mEq/ml	<u>7.5</u>	ml
magnesium sulfate	4mEq/ml	<u>4.0</u>	ml
calcium gluconate	10% (0.465mEq/ml)	<u>10.0</u>	ml
		total: <u>≈50</u>	ml

**infusion rate:** 83 ml/hr