4. A 88yo, 154 lb, 5’ 4” female is admitted for intestinal obstruction. She is to be placed on TPN until 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 acidic. 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)  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: 55 – 66 g protein/day
hospitalized patient: 1-1.2g/kg/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) 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
46.75g/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)

amt/1000 calories  (amt)(# daily cals)/1000  amount/bag
sodium  40-50 mEq  59 – 74  divide  40  mEq
potassium  40mEq  59  each  35  mEq
magnesium  8-12mEq  12 – 17 by 1.7  8  mEq
calcium  2-5 mEq  3 – 7  to get  2  mEq
phosphate  15-25mMol  22 - 37  amt/bag  18  mMol
chalk test: (18)(2) + 2 = 38 so OK

9. Calculate the volume of each electrolyte solution that you will add volume to add
sodium chloride  23.4% (4mEq/ml)  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 ml ÷ 24 hrs = 71 ml/hr
TPN Worksheet using pump

age: 88  sex: F

height: 163 cm  ABW: 70 kg  IBW: 54 kg  feed weight: 55 kg
day

Target:

2. Daily fluid needs.

>20 kg: 1500ml + (20 ml)(W - 20 kg) 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/day
hospitalized 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)
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: 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 g/day)(100 ml/10 g) = 600 ml

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

3.5 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 g/day)(100 ml/70 g) = 395.7 = 400ml
(400 ml/70 g/100 ml)(3.4 kcals/g) = 952 kcals from CHO

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

1400 kcals – 952 CHO kcals = 448 kcals to give as fat
550kcals/500ml 10% lipid 900kcals/500ml of 20% lipid or

(448 kcals fat)(1 g fat/9 kcals)(100 ml/20 g fat) = 248 ml = 250 ml 20% fat

20% lipid calculated volume: 250 ml plus sterile water volume: 400 ml

1700ml – 600ml AA – 400 ml CHO – 250 ml fat – 50 ml lytes = 400 ml as water

Electrolytes:

8. Daily electrolyte needs

amt of kcals/day from fat and dextrose: 952 + 450 = 1400 kcals (32% fat)

<table>
<thead>
<tr>
<th>electrolyte</th>
<th>amount/bag</th>
</tr>
</thead>
<tbody>
<tr>
<td>sodium</td>
<td>64 mEq</td>
</tr>
<tr>
<td>potassium</td>
<td>59 mEq</td>
</tr>
<tr>
<td>magnesium</td>
<td>16 mEq</td>
</tr>
<tr>
<td>calcium</td>
<td>4.65 mEq</td>
</tr>
<tr>
<td>phosphate</td>
<td>30 mMol</td>
</tr>
</tbody>
</table>

chalk test: (30)(2) + 5 = 65 1.7 = 38/L so OK

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

volume to add

<table>
<thead>
<tr>
<th>electrolyte</th>
<th>amount/bag</th>
</tr>
</thead>
<tbody>
<tr>
<td>sodium chloride</td>
<td>16.0 ml</td>
</tr>
<tr>
<td>sodium acetate</td>
<td>0.0 ml</td>
</tr>
<tr>
<td>potassium phosphate</td>
<td>10.0 ml</td>
</tr>
<tr>
<td>potassium chloride</td>
<td>7.5 ml</td>
</tr>
<tr>
<td>magnesium sulfate</td>
<td>4.0 ml</td>
</tr>
<tr>
<td>calcium gluconate</td>
<td>10.0 ml</td>
</tr>
</tbody>
</table>

total: 50 ml

infusion rate: 83 ml/hr