2. A 72yo, 96 lb, 5’ 2” female receives a colon resection after a diagnosis of obstructive colon cancer. She is to be placed on TPN while her bowel heals. Labs are:

- **sodium**: 132 mEq/L, normal range 135 – 150 mEq/L
- **potassium**: 3.2 mEq/L, normal range 3.5 – 5.0 mEq/L
- **chloride**: 99 mEq/L, normal range 100 – 106 mEq/L
- **bicarbonate**: 29 mEq/L, normal range 24 – 30 mEq/L
- **BUN**: 3 mg/dL, normal range 8 – 20 mg/dL
- **creatinine**: 0.5 mg/dL, normal range 0.6 – 1.2 mg/dL
- **glucose**: 101 mg/dL, normal range 70 – 110 mg/dL, fasting
- **calcium**: 7.8 mEq/L, normal range 8.5 – 10 mEq/L
- **phosphate**: 3.1 mg/dL, normal range 2.6 – 4.5 mg/dL
- **magnesium**: 1.4 mEq/L, normal range 1.8 – 2.5 mEq/L
- **prealbumin**: < 7.0 mg/dL, normal range 16 – 40 mg/dL (acute nutritional status)
- **albumin**: 2.1 g/dL, normal range 3.5 – 5 g/dL (long-term nutritional status)
- **triglycerides**: 125 mg/dL, desired range < 200 mg/dL (if these are high need to limit fat calories)

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

**Analysis of patient situation:**

- She is hospitalized and S/P (status post: this means that she is just after experiencing…) surgery and thus needs a low stress adjustment of around 1.2.
- Her ABW = 43 kg and IBW = 50 kg, so a feed weight could be anything from 44-50 kg. Since she is underweight, most pharmacists would choose a feed weight higher than 44 kg. In this case I shall choose a feed weight in the middle of the range.
- Most of her electrolyte values are on the lower end of the average range. One of the things that could cause this would be overhydration after surgery (not difficult to do with such a small individual) causing dilution of her blood and therefore her serum electrolyte concentrations. If her kidneys are in good shape, this will correct itself pretty quickly (i.e., within a few days) as long as the amount of fluid going into her slows down. It would be useful to know her blood pressure, urine output, and other signs of volume status in order to determine a good volume for her TPN. In the absence of such information it would be prudent to go on the low side with volume, because of the effect of age on kidney function.
- Her calculated creatinine clearance is anywhere from 34 – 70 ml/min/ depending upon whether you correct the serum creatinine to 1.0 [(140-72)(44)/(85)(1.0) = 34 ml/min] or you leave it as it is [(140-72)(44)/(85)(0.5) = 70 ml/min]. Notice that the ABW was used in these calculations instead of the IBW – this is because creatinine is a byproduct of muscle breakdown and she can only break down muscle that she has (44 kg). If we were to use the IBW of 50 kg, we would be assuming that she has 6 kg more muscle than she really has.
- Her albumin is low so her calcium needs to be corrected to reflect this and determine whether she needs extra calcium or is probably fine to receive the recommended daily amount. Her corrected calcium is (4.0 – 2.1)(0.8) + 7.8 = 9.3 mEq/L, which is in the normal range. Her calcium and albumin may actually be higher; as mentioned previously, if she is volume overloaded then her labs will appear lower than they actually are secondary to dilution.
- Most of her lab values are a bit on the low side, but will correct within the next few days if this is due to post-surgical overhydration and if her kidneys are in good enough shape to excrete the excess volume. There is no reason at this point to go low or high on administration of any of the electrolytes.
- Her chloride is low and her bicarb is high, so she is somewhat alkalotic. You will therefore want to give sodium as the chloride salt, rather than the acetate salt.
- Her triglycerides are OK, so don’t need to restrict fat amount at this time.
TPN Worksheet using pre-set volumes

age: 72 sex: F
height: 157 cm ABW: 44 kg IBW: 50 kg feed weight: 47 kg

anything 44-60 would be fine here

Targets:

1. Daily fluid needs.
>20 kg: 1500 ml + (20 ml)(W - 20 kg) 2040
30 - 35 ml/kg/day 1410 – 1645
calculated target: 1410 - 2040 ml/day
I will stay low so choose target volume of 1500 ml/day

2. Protein requirements.
normal, unstressed individual: 0.8g/kg/day
calculated target: 47 - 56 g protein/day
hospitalized patient: 1-1.2g/kg/day
stressed patient: 1.5-2g/kg/day

3. Non-protein calories
BEEmen = 66.67 + 13.75(W) + 5.0(H) - 6.76(A)
calculated target: 1500 kcals/day
BEEwomen = 665.1 + 9.56(W) + 1.86(H) - 4.68(A) 1070

activity factors: confined to bed: 1.2 out of bed: 1.3 1283
stress factors: surgery: 1.2; infection: 1.4; trauma: 1.5; burns: 1.7 1540

TDE = (BEE) (activity factor) (stress factor)

Amounts:

4. Total TPN volume 1500 ml/day; volume for each TPN: 1000 ml/bag; # bags/day: 1.5

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
41g/day 64g/day either are outside recommendations – will go high
10% AA calculated volume: ___________ ml since this gives her < 1.4 g/kg/day – not excessive

6. Dextrose volume (3.4 kcals/g) choose one
3.5 mg/kg/min = .237 g/day = 158 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)(1.5 bags/day)(3.4 kcals/g) = 510 kcals CHO

D70W calculated volume: ___________ ml 1500 kcals – 510 kcals CHO = 990 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: 510 + 900 = 1410 kcals (64% fat)

<table>
<thead>
<tr>
<th>electrolyte</th>
<th>amt/1000 calories</th>
<th>(amt)(# daily cals)/1000</th>
<th>amount/bag</th>
</tr>
</thead>
<tbody>
<tr>
<td>sodium</td>
<td>40-50 mEq</td>
<td>63 – 79 divide</td>
<td>48 mEq</td>
</tr>
<tr>
<td>potassium</td>
<td>40mEq</td>
<td>63 each</td>
<td>42 mEq</td>
</tr>
<tr>
<td>magnesium</td>
<td>8-12mEq</td>
<td>13 – 19 by 1.5</td>
<td>10 mEq</td>
</tr>
<tr>
<td>calcium</td>
<td>2-5 mEq</td>
<td>3 – 8 to get</td>
<td>3.3 mEq</td>
</tr>
<tr>
<td>phosphate</td>
<td>15-25mMol</td>
<td>24 – 39 amt/bag</td>
<td>18 mMol</td>
</tr>
</tbody>
</table>

chalk test: (18)(2) + 3.3 = 39.3; so OK

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

sodium chloride 23.4% (4mEq/ml) 12.0 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 7.8 ml
magnesium sulfate 4mEq/ml 2.5 ml
calcium gluconate 10% (0.465mEq/ml) 7.1 ml

volume to add

infusion rate: 63 ml/hr 1500 ml ÷ 24 hrs = 63 ml/hr
TPN Worksheet using pump

age: 72  sex: F

height: 157 cm  ABW: 44 kg  IBW: 50 kg  feed weight: 47 kg

anything 44-60 would be fine here

Targets:
1. Daily fluid needs.
   >20 kg: 1500ml + (20 ml)(W - 20 kg) 2040
   30 - 35 ml/kg/day 1410 – 1645
   calculated target: 1410 - 2040 ml/day
   I will stay low so choose target volume of 1500 ml/day

2. Protein requirements.
   normal, unstressed individual: 0.8g/kg/day
   calculated target: 47 - 56 g protein/day
   [hospitalized patient: 1-1.2g/kg/day]
   I will choose 56 g/day to reflect stress level
   stressed patient: 1.5-2g/kg/day

3. Non-protein calories
   BEEmen = 66.67 + 13.75(W) + 5.0(H) - 6.76(A)
   calculated target: 1500 kcals/day
   BEEwomen = 665.1 + 9.56(W) + 1.86(H) - 4.68(A)
   calculated target: 1070 kcals/day
   activity factors:
   [confined to bed: 1.2]  out of bed: 1.3 1283
   stress factors:
   [surgery: 1.2]  infection: 1.4; trauma: 1.5; burns: 1.7 1540
   TDE = (BEE) (activity factor) (stress factor)

Amounts:

4. Total TPN volume 1500 ml/day; volume for each TPN: 1500 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: 560 ml
   (56 g/day)(100 ml/10 g) = 560 ml

6. Dextrose volume (3.4 kcals/g) choose one
   3.5 mg/kg/min = 237 g/day
   100g in D20W 500ml
   250g in D50W 500ml
   350g in D70W 500ml
   D70W calculated volume: 340 ml
   (237 g/day)(100 ml/70 g) = 339 g = 340 ml
   (340 ml/70 g/100 ml)(3.4 kcals/g) = 809 kcals from CHO

7. Fat volume (9 kcals/g) choose one:
   1500 kcals – 809 CHO kcals = 691 kcals to give as fat
   550kcals/500ml 10% lipid
   900kcals/500ml of 20% lipid or
   (691 kcals fat)(1 g fat/9 kcals)(100 ml/20 g fat) = 384 ml 20% fat
   20% lipid calculated volume: 384 ml
   plus sterile water volume: 157 ml
   1500ml – 560ml AA – 340 ml CHO – 384 ml fat = 216 ml remaining

Electrolytes:

8. Daily electrolyte needs
   total amt of kcals/day from fat and dextrose: 809 + 691 = 1500 kcals (46% fat)

9. Calculate the volume of each electrolyte solution that you will add
   volume to add
   sodium chloride 23.4% (4mEq/ml)
   17.0 ml
   sodium acetate 16.4% (2mEq/ml)
   0.0 ml
   potassium phosphate: 3mEq phosphate/ml, 4.4 mEq potassium/ml
   10.0 ml
   potassium chloride 2mEq/ml
   8.0 ml
   magnesium sulfate 4mEq/ml
   4.0 ml
   calcium gluconate 10% (0.465mEq/ml)
   10.0 ml
   vitamins
   10.0 ml
   total: 59 ml

infusion rate: 63 ml/hr