5. A 41yo, 134 lb, 5’ 5” female is admitted for surgical removal of a large adrenal tumour. She is to be placed on TPN in anticipation of a prolonged NPO post-operative course. Labs are:

- Sodium: 139 mEq/L (normal range 135 – 150 mEq/L)
- Potassium: 3.7 mEq/L (normal range 3.5 – 5.0 mEq/L)
- Chloride: 102 mEq/L (normal range 100 – 106 mEq/L)
- Bicarbonate: 28 mEq/L (normal range 24 – 30 mEq/L)
- BUN: 12 mg/dL (normal range 8 – 20 mg/dL)
- Creatinine: 0.6 mg/dL (normal range 0.6 – 1.2 mg/dL)
- Glucose: 157 mg/dL (normal range 70 – 110 mg/dL, fasting)
- Calcium: 10.1 mEq/L (normal range 8.5 – 10 mEq/L)
- Phosphate: 1.6 mg/dL (normal range 2.6 – 4.5 mg/dL)
- Magnesium: 1.7 mEq/L (normal range 1.8 – 2.5 mEq/L)
- Albumin: 3.1 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.

Analysis of patient situation:

- She is post-surgical and the surgery was more than minor surgery but probably not at the level of trauma, so probably needs a stress adjustment of 1.2 – 1.4.
- Her ABW = 61 kg and IBW = 57 kg, so a feed weight could be anything at either end or between these numbers. In this case I will use her IBW as her feed weight.
- Her calculated creatinine clearance is anywhere from 66 – 110 ml/min/ depending upon whether you correct the serum creatinine to 1.0 or leave it as it is. Either number indicates that her kidneys are in good shape and as far as you know she doesn’t have any concomitant volume-sensitive disease states so you don’t need to worry about volume overload.
- Her albumin is a little low. Her calcium corrects to a number that is high. Hypercalcemia (high serum calcium concentrations) is relatively common with some malignancies. We hope that removal of the tumour will allow normalization of her serum calcium, but will go on the low end of the calcium recommendations; some pharmacists may choose to omit the calcium entirely until normalization occurs and this is also an option.
- Her phosphate is a bit low so may choose a phosphate amount in the higher end of the recommended range.
- Her chloride and bicarb are fine, so there is no need to worry about acidosis or alkalosis. Can give sodium as the chloride salt.
TPN Worksheet using pre-set volumes

age: 41  sex: F
height: 165 cm  ABW: 60 kg  IBW: 57 kg  feed weight: 57 kg

anything 57-60 would be fine here

Targets:

1. Daily fluid needs.
   >20 kg: 1500ml + (20 ml)(W - 20 kg) 2240
   30 - 35 ml/kg/day 1710 - 1995
   calculated target: 1700 – 2200 ml/day

2. Protein requirements.
   normal, unstressed individual: 0.8g/kg/day
   calculated target: 68 – 80 g protein/day
   hospitalized patient: 1-1.2g/kg/day
   stressed patient: 1.5-2g/kg/day
   1.2 – 1.4 since she’s between hospitalized and stressed

3. Non-protein calories
   BEE
   BEE
   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) (1385)(1.2)(1.2 – 1.4) = 1900 – 2200 kcals/day

Amounts:

4. Total TPN volume 1700 ml/day; volume for each TPN: 1000 ml/bag; # bags/day: 1.7
   she’ll be getting fat separately, so went with lower end of volume 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
   72 g/day

6. Dextrose volume (3.4 kcals/g) choose one
   3.5 mg/kg/min = 287 g/day = 143 g/bag
   100g in D20W 500ml
   250g in D50W 500ml
   350g in D70W 500ml or
   50% is theoretically too high, but if we go with 20%, she would have to get 71% of her calories from fat, which is too high. In this case, then, we’ll use the higher sugar amount (5.2 mg/kg/minute) and watch her chloride/bicarb concentrations to see if she becomes acidic. (250 g/bag)(1.7 bags/day)(3.4 kcals/g) = 1445 kcals CHO
   2000 kcals – 1445 kcals CHO = 555 kcals to give as fat

7. Fat volume (9 kcals/g) choose one:
   550kcals/500ml 10% lipid
   900kcals/ 500ml of 20% lipid

Electrolytes:

8. Daily electrolyte needs total amt of kcals/day from fat and dextrose: 1445 + 550 = 1995 kcals (28% 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>80 - 100</td>
<td>divide</td>
</tr>
<tr>
<td>potassium</td>
<td>40mEq</td>
<td>80</td>
<td>each</td>
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<tr>
<td>magnesium</td>
<td>8-12mEq</td>
<td>16 - 24</td>
<td>by 1.7</td>
</tr>
<tr>
<td>calcium</td>
<td>2-3 mEq</td>
<td>4 - 10</td>
<td>to get</td>
</tr>
<tr>
<td>phosphate</td>
<td>15-25mMol</td>
<td>30 - 45</td>
<td>amt/bag</td>
</tr>
</tbody>
</table>

   chalk test: (21)(2) + 2.3 = 44.3 so OK

9. Calculate the volume of each electrolyte solution that you will add
   volume to add
   sodium chloride 23.4% (4mEq/ml) 13.0 ml
   sodium acetate 16.4% (2mEq/ml) 0.0 ml
   potassium phosphate: 3mMol phosphate/ml, 4.4 mEq potassium/ml 7.0 ml
   potassium chloride 2mEq/ml 8.0 ml
   magnesium sulfate 4mEq/ml 3.0 ml
   calcium gluconate 10% (0.465mEq/ml) 5.0 ml

   infusion rate: 71 ml/hr 1700 ml ÷ 24 hrs = 71 ml/hr
**TPN Worksheet using pump**  
**age:** 41  
**sex:** F

- **height:** 165 cm  
- **ABW:** 60 kg  
- **IBW:** 57 kg  
- **feed weight:** 57 kg  

**Targets:**

1. **Daily fluid needs.**
   - >20 kg: 1500ml + (20 ml)(W - 20 kg) 2240  
   - 30 - 35 ml/kg/day 1710 - 1995  
   - calculated target: 1700 – 2200 ml/day

2. **Protein requirements.**
   - normal, unstressed individual: 0.8g/kg/day  
   - hospitalized patient: 1.2g/kg/day  
   - stressed patient: 1.5 - 2g/kg/day  
   - calculated target: 75 g protein/day

3. **Non-protein calories**
   - BEE men = 66.67 + 13.75(W) + 5.0(H) - 6.76(A)  
   - BEE women = 665.1 + 9.56(W) + 1.86(H) - 4.68(A)  
   - calculated target: 2000 kcals/day

   - 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  
   - TDE = (BEE) (activity factor) (stress factor) (1385)(1.2)(1.2 – 1.4) = 1900 – 2200 kcals/day

**Amounts:**

4. **Total TPN volume**  
   - 2000 ml/day; volume for each TPN: 2000 ml/bag; # bags/day: 1
   - *I will use a larger amount here since fats will be included in TPN volume*

5. **Protein Volume**
   - 10% AA calculated volume: 750 ml  
   - (75 g/day)(100 ml/10 g) = 750 ml

6. **Dextrose volume** (3.4 kcals/g)
   - 3.5 mg/kg/min = 287 g/day; 4 mg/kg/day = 328 g/day  
   - D70W calculated volume: 460 ml  
   - (460 ml)(70 g/100 ml)(3.4 kcals/g) = 1095 kcals from CHO  
   - 2000 kcals – 1095 CHO kcals = 905 kcals to give as fat

7. **Fat volume** (9 kcals/g)
   - (905 kcals fat)/(1 g fat/9 kcals)(100 ml/20 g fat) = 500 ml 20% fat  
   - 20% lipid calculated volume: 500 ml  
   - plus sterile water volume: 210 ml  
   - 2000 ml – 750 ml AA – 460 ml CHO – 500 ml fat = 290 ml remaining; 77 ml given as e’lytes so 210 given as water

**Electrolytes:**

8. **Daily electrolyte needs**
   - total amt of kcals/day from fat and dextrose: 1095 + 900 = 1995 kcals (45% fat)
   - chalk test: (39)(2) + 5 = 83 + 2 = 41.5/L so OK

<table>
<thead>
<tr>
<th>electrolyte</th>
<th>amt/1000 calories</th>
<th>(amt)/(# daily cal)/1000</th>
<th>amount/bag</th>
</tr>
</thead>
<tbody>
<tr>
<td>sodium</td>
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<td>potassium</td>
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<td>magnesium</td>
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<td>16 – 24</td>
<td>20 mEq</td>
</tr>
<tr>
<td>calcium</td>
<td>2-5 mEq</td>
<td>4 – 10</td>
<td>4.65 mEq</td>
</tr>
<tr>
<td>phosphate</td>
<td>15-25mMol</td>
<td>30 – 50</td>
<td>39 mMol</td>
</tr>
</tbody>
</table>

   - *infusion rate: 83 ml/hr*

9. **Calculate the volume of each electrolyte solution that you will add**
   - volume to add
   - sodium chloride 23.4% (4mEq/ml)  
   - sodium acetate 16.4% (2mEq/ml)  
   - potassium phosphate: 3mMol phosphate/ml, 4.4 mEq potassium/ml  
   - potassium chloride 2mEq/ml  
   - magnesium sulfate 4mEq/ml  
   - calcium gluconate 10% (0.465mEq/ml)  
   - vitamins, other additives
   - total: 77 ml