Case Study #2: Enteral and Parenteral Nutrition
Due 2/14/14
60 points

Mr. R, a 35 yo drug user, is hospitalized after a motor vehicle accident (MVA). He is currently suffering from a severe concussion and lapses of consciousness, a broken jaw, multiple broken bones, and possible internal injuries. He had not eaten anything for several days PTA because he was overdosing on drugs. Enteral feeding has been recommended in order to improve his nutritional status and given his decreased level of alertness. The patient will be bedridden until his mental status improves. A nasogastric feeding tube has been inserted and the physician has asked for your recommendation regarding the type of formula and amounts of kcal/protein needed for this patient.

Ht: 5’11”          Current wt: 156 #          UBW: 167 #          Serum albumin: 3.0 mg/dL

= 71 inches = 180.34 cm   156# = 70.9 kg   167# = 75.9 kg   Serum Albumin = Low

1. Write 1 PES statement for this patient. (2 pts)

Inadequate energy intake (NI-1.4) r/t broken jaw, other MVA injuries, and drug overdose AEB low serum albumin and enteral feeding recommendation.

Source: NTP Appendix C-2

2. Is the nasogastric feeding route appropriate for this patient? Why or why not? (3 pts)

Enteral feeding is definitely necessary for this patient because he is unable to take nutrients in by mouth due to his broken jaw and overdose. However, I do not believe nasogastric is the best route for him. A nasoduodenal route would be better suited for this patient. While his gut is functioning and he has no esophagus or stomach anomalies, he is at high risk for aspiration due to his decreased level of alertness and lapses of consciousness from his severe concussion. A nasoduodenal tube feeding should also be appropriate because it will be relatively short-term, until his jaw has healed. The patient also may have possible internal injuries and if these internal injuries are to the stomach, this would be another contraindication for a nasogastric tube.

Source:
NUT 116BL Lecture on Parenteral and Enteral Nutrition Page 12

3. What daily intake of kcals, protein, and fluids would you recommend for this patient and why? Show calculations for estimated needs, give recommendations as kcal/d, g protein/d, ml fluid/d. (6 pts)

a) Energy Needs
MSJ:
REE for males = 10W + 6.25H – 5Age + 5
10 (70.9kg) + 6.25 (180.34cm) – 5(35) +5
Energy Needs = 1666.13
1666.13 kcal x 1.2 (AF) = 1999.36
I used a 1.2 AF because he is confined to his bed due to multiple broken bones and possible internal injuries.
1999.36 x 1.1-1.3 (IF) = 2199.3-2599.17 kcal/d recommended. I would recommend this amount of kcal/d due to his very low activity factor and his injury factor from the accident.

I used an IF of 1.1-1.3 because of multiple/long bone fractures.
Check: 25-30kcal/g = 1772.5kcal/d – 2127kca/d
What I found for energy needs is slightly greater then this but this is due to his injury factor and increased healing needs.

Source: For Activity Factor and Injury Factor I used NTP page 60 and Pocket Resource Page 20 (Dr. Braun mentioned in office hours that these numbers would be fine if sources cited)

b) Protein Needs
70.9kg x 1.2-1.5 g = 85.08g/d – 106.35g/d
I used 1.2-1.5 g/kg because the patient is under moderate-severe stress due to multiple broken bones and possible internal injuries.

Source: Reviewed this from protein in discussion

c) Fluid Needs
1ml/kcal = 2199.3-2599.17 ml/day

4. Based on the needs of this patient, describe three desirable characteristics for the type of formula you would recommend. Give one example of an appropriate enteral formula meeting these characteristics. Use Appendix C2 in NTP text or websites of formula companies, such as Nestlenutrition.com/us or Abbottnutrition.com. (4 pts)

The patient came in following a MVA accident. While he does have a drug problem and several fractures, he does not have any serious GI problems, kidney problems, or liver problems. Three desirable characteristics for the patient’s formula would be: a) Mr. R needs an enteral formula that meets his protein needs b) Mr. R can have a formula that is fiber-enriched because he does not have any GI issues and therefore does not need to be on GI rest c) Mr. R has no fluid restrictions and therefore does not need any fluid restricted formulas. It is also important the Mr. R has immune support in his formula to fight possible infection. Because the patient should be able to tolerate a relatively normal enteral formula, I am going to recommend he use Jevity 1.2 Formula.

Source: Chose Jevity 1.2 Formula from the Formulary from discussion

5. a) Based on the enteral formula you selected in question 3 above, what daily total volume of formula would meet Mr. R’s estimated kcal and protein needs? Show calculations. (3 pts)

Mr. R needs 2199.3-2599.17 kcal/day.
Jevity 1.2 = 1.2kcal/mL

2199.3 kcal/1.2kcal/ml = 1832.8 ml of TF formula
1832.8 ml/24 hours = 76.4ml/hr = 80 ml/hr
80 ml/hr x 24 hours = 1920 ml TF/day
1.92 L x 55g protein/L = 105.6 g protein → This is within the range of protein calculated for Mr. R above
1920 ml TF/d x 1.2 kcal/ml = 2304 kcal → This is within the rage for calories for Mr. R
A daily total volume of 1920 ml TF/day will give us an appropriate amount of kcal and protein that Mr. R requires. 1920 ml of TF gives us 2304 kcal and 105.6g protein.

b) What would be the hourly rate for delivery of this tube feeding as a continuous 24hr infusion? Show calculations. (1 pt)

\[
\frac{2199.3 \text{ kcal}}{1.2 \text{ kcal/ml}} = 1832.75 \text{ ml of TF formula}
\]
\[
\frac{1832.75 \text{ ml}}{24 \text{ hours}} = 76.36 \approx 80\text{ml/hr} \text{ (told to round up in discussion)}
\]
Mr. R would be receiving 80 ml/hr. You would not start the patient off with 80 ml/hr but this is the goal rate.

c) Is this volume of tube feeding adequate to meet his fluid needs? If not, indicate what else is needed and how it would be added to the current tube feeding. Show calculations. (4 pts)

\[
80\text{ml/hr} \times 24 \text{ hours} = 1920 \text{ ml total volume TF/day} \rightarrow \text{No, this is not enough adequate to meet his fluid needs. There needs to be a little more fluid added to Mr. R’s formula. Fluid should be added in the form of protein to avoid risk of too much dextrose or lipids.}
\]
\[
2199.3 \text{ ml needed} - 1920 \text{ ml in formula} = 279.3 \text{ ml}
\]
\[
24 \text{ hr fluid flush every 6 hours (4x a day)} = 279.3 \text{ ml} / 4 = 69.825 = 70 \text{ ml every 6 hours}
\]
In order to provide adequate fluid there should be free water flushes of 70 ml every 6 hours.

6. Give 3 blood values that you would monitor for this patient and the reasons why. (6 pts)

a) Prealbumin/Albumin

Both of these measure protein in the patient. Prealbumin is often more accurate when testing for protein in the patient because it has a shorter half-life and is more sensitive to changes in protein-energy status. It is important to check albumin to monitor EN patients and see if any EN adjustments are needed. Keeping track of prealbumin is important to make sure protein-energy malnutrition is not occurring. Checking for prealbumin is also important to monitor inflammation and infections. Any low levels can indicate malnutrition and inflammation.

b) C-Reactive Protein

CRP is an acute-phase protein and can monitor the adequacy of the diet the patient is getting enterally. When it is elevated CRP it can also mean that prealbumin is abnormal. CRP is a marker for inflammation in the body, although it can’t pinpoint exactly where the inflammation is. If Mr. R’s CRP level is high when tested it could mean there is an infection.

c) Electrolytes: How are the magnesium, potassium, phosphorous

Enteral fed patients can have issues with their electrolyte balances. Electrolytes need to be monitored in Mr. R to make sure that he is not having refeeding syndrome. Refeeding syndrome can occur in malnourished patients and are suddenly refed, leading to electrolyte imbalances: hypophosphatemia, hypokalemia, and hypomagnesemia. The are more side effects of refeeding syndrome, like hyperglycemia, sodium retention, arrhythmias, and heart failure, which is why
these electrolytes need to be monitored. Hypophosphatemia causes phosphate to shift into the cells, hypokalemia can occur if the potassium intake is less than the required amount, and hypomagnesemia can occur from extracellular magnesium deficiency if inadequate amounts are present in the formula.

Source: NUT 116BL Lecture Notes Page 51

7. Give one urine value that you would monitor and the rationale for monitoring it. (2 pts)

One urine value that I would measure is Sodium. Urine Sodium tests are done to check how much fluid the body has. With enteral feeding I want to make sure that Mr. R is receiving enough fluids. If there are lower than normal urine sodium levels, this could mean that Mr. R is not receiving enough fluid in the body and that there is a potential he is having fluid loss through diarrhea. Diarrhea is a potential side effect of enteral feeding so this is something to be cautious of. If the formula is too hypotonic, this can also lead to dilution of the sodium level.

The patient, Mr. R, is now 5 days s/p his MVA. He did not tolerate the enteral feedings well (diarrhea and pain) and now has been diagnosed with acute pancreatitis. The MD has ordered a nutrition consult for evaluation of parenteral nutrition (PN) support. For the purposes of answering questions 7-12, assume that your current estimated kcal and protein needs for Mr. R are: 2600 kcal/day and 110 g protein/day.

8. Write a PES statement. (2 pts)

Altered GI function (NC – 1.4) r/t recent dx of acute pancreatitis AEB intolerance to enteral feeding, diarrhea, pain.

9. Which type of PN support do you recommend – central or peripheral? Justify your answer. (2 pts)

It is recommended that Mr. R use Central Parenteral Nutrition. His calorie needs are too high for peripheral nutrition at a recommended 2600 kcal. With peripheral parenteral nutrition you have to have a decreased osmolality (<900 mOsm/L) to prevent thrombophlebitis. Central access allows a higher osmolality formula to be administered because it is a high flow area that quickly dilutes the solutions. Another reason why the central route is a better choice is because Mr. R will need the IV fluids for a longer period of time.

Source: NUT 116B Nutrition Support Lecture Page 33

10. Calculate the amount of a 10% lipid emulsion that is needed to provide around 20% of Mr. R’s total kcal needs. Show calculations. (2 pts)

Mr. R will need a 500 ml bag.

Total kcal needs = 2600 kcal/d
0.2 x 2600 kcal/d = 520 calories
10% lipid emulsion = 1.1 kcal/ml
520 kcal/1.1 kcal/ml = 472.73 ml

There are only 100 ml, 250 ml, and 500 ml bags so we will use a 500 ml bag
500 ml x 1.1 kcal/ml = 550 kcal

11. The MD wants the dextrose and amino acid solution to be a total volume of 2 L/day. (The volume of lipid emulsion is separate from this 2 L.)

a) Determine the final amino acid concentration of this solution, which would supply 110 g protein/day. Show calculations. (2 pts)
110 g protein/2000 ml x 100 = 5.5% is the final amino acid concentration of the solution

b) Determine the remaining kcals to be provided as CHO. Express your answer as kcals from CHO and as grams of dextrose. Show calculations. (3 pts)
550 ml bag x 1.1 kcal/ml = 550 kcal from fat
110 g protein x 4 kcal/g = 440 kcal from protein
550 kcal from fat + 440 kcal from protein = 990 kcal
2600 total kcal – 990 kcal = **1610 kcal from CHO**
1610 kcal/3.4 kcal/g = **473.53 g dextrose needed**

c) Determine the final dextrose concentration of the solution. Show calculations. (2 pts)
473.53 g dextrose/2000 ml fluid = **23.7% dextrose**

d) If the PN solution had to be made from a starting stock solution of D50W (500 g dextrose in 1 L of water), what volume of this stock D50W would be needed to provide the grams of dextrose that you calculated in question 9b above? Show calculations. (2 pts)

500 g dextrose in 1 L of water
500 g/1000 ml = 473.53 g/x mls
x = 947.06 ml
You would need **947.06 ml** of this stock to provide the 473.53 g of dextrose.

e) Compare the grams of dextrose to be provided in this solution with the maximum glucose infusion rate for Mr. R of 5 mg/kg BW/min. Would you make any changes to the PN solution based on this information? If so, how would you change it? (2 pts)

too much dextrose → hepatic steatosis → can lead to liver dysfunction

5 mg x 70.9 kg BW = 354.5 mg/min x 1 g/1000 mg = 0.3545 g dextrose/min = 510.48 g/d
473.53 g dextrose = 4.6 mg/kg/min
4.6 mg/kg/min of dextrose he needs falls under the 5 mg/kg/min → This shows he is in the high end for acceptable range but the solution can be tried. It is important that if this solution is used that it is closely monitored. It may be necessary to increase the calories not from carbohydrates
but from fat in order to prevent the risk of liver dysfunction. With this solution it is important to monitor for hepatic steatosis because this can lead to liver dysfunction and we do not want the patient having to have a liver transplant.

12. List three lab values that you would monitor for this patient and the reasons why. (6 pts)

a) Micronutrients i.e. Ca, Mg, Phosphate, Iron – It is important to monitor these micronutrients to make sure a patient does not experience refeeding syndrome. Refeeding syndrome is often characterized by low phosphate levels. In addition this, low copper and iron levels can lead to anemia; it is very difficult to meet someone’s calcium and phosphorous needs – their bone density will deteriorate because of our inability to meet their needs (chemistry wise) in a bag.

b) Glucose – Important to monitor to prevent hyperglycemia is prevalent in many patients receiving TPN. High glucose levels can lead to longer hospital stays, more complications, and an increased risk of mortality. In addition to this, high dextrose levels can lead to hepatic steatosis and ultimately liver dysfunction. If these levels aren’t monitored then it could result the patient having to have a liver transport.

c) Lipids/Serum Triglycerides – It is important to monitor lipids to assess lipid clearance. While lipids are important in TPN in order for patients to receive their essential fatty acids, some patients may be at higher risk for developing hyperlipidemia, like diabetics. If patients experience decreased lipid clearance and an accumulation of fat, this can result in liver dysfunction, immune system problems, anemia, and cardiac dysfunction.

Source: Discussed in office hours

13. Mr. R develops hyperglycemia while on PN support. Describe two actions you would recommend to help lower blood glucose and achieve metabolic control of the patient. (2 pts)

Hyperglycemia can occur in overfeeding a patient. High blood glucose levels can occur because of too many calories being taken in via TPN from carbohydrates. Levels should be monitored. One action that would work to reduce blood glucose levels would be to slow down the TPN infusion rate so that the patient is receiving less glucose into the blood stream at once and allows more time for the body to react and release insulin. Another possible strategy would be to add insulin into the TPN so that less glucose remains in the blood stream.

14. What is refeeding syndrome? Why is it important to monitor for refeeding syndrome in a severely malnourished patient who is started on PN? (4 pts)

Refeeding syndrome can occur in patients undergoing parenteral nutrition within the first days or first week of nutrition repletion. It occurs when patients are re-fed too quickly, leading to fluctuations in fluid and electrolytes which can cause metabolic and neuromuscular problems. When patients are fed high levels of carbohydrates too quickly, glucose and electrolytes shift into intracellular space. Increased carbohydrates can also lead to increased insulin secretion and reduced water and sodium excretion and leaves patients at risk of fluid overload and edema. Tissue growth and repair also causes K, P, and Mg to shift into cells. Symptoms are fatigue, muscle weakness, cardiac dysfunction, and potential death. It is important to monitor potassium, phosphorous, magnesium, glucose, and daily weights. levels in severely malnourished patients who start parenteral nutrition because of the increased nutrients and calories they are getting with
the PN. By increasing calories too quickly, the patient is at high risk of refeeding syndrome because of their previously malnourished state. Increase calories slowly, starting with ½ of goal, restrict total volume and sodium input the first few days, and provide only 150-200g/day of CHO. It is important to monitor for refeeding syndrome because when you go from severely malnourished to parenteral nutrition you can potentially be giving too much too quickly which will result in these electrolyte imbalances and refeeding syndrome. Severely malnourished patients are at high risk for refeeding syndrome because they are so depleted and refeeding will cause a sudden increase in insulin release and a shift of phosphate, glucose, potassium, magnesium, and water which can result in edema.

Source: NUT 116B Lecture on Nutrition Support page 41