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Case Study #2: Enteral and Parenteral Nutrition

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

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

(NI-1.2) Inadequate energy intake r/t MVA AEB decreased level of alertness, broken jaw, broken bones, possible internal injuries and pt's report of NPO for several days PTA.

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

Yes, the nasogastric feeding route is appropriate for this patient. The patient is unable to take food orally due to his broken jaw and decreased level of alertness. Also, since he hasn't had food in several days, he is in need of nutrients, especially protein to recover from his injuries. Since the patient has normal gut activity, nasogastric feeding route is appropriate to retain his gut integrity. However, if his broken jaw takes a long time to recover, or his level or alertness is taking a while to recover, he may want to be on gastrostomy instead of nasogastric tube. Gastrostomy will also deliver his needs and retain his gut integrity but is for patients needing a longer term feeding tube.

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)

Wt = 156# / 2.2 kg= 70.9 kg
Ht = 71 in*2.54 cm = 180.34 cm

Estimated Kcal Needs (PR pg 17)
BMR= 10(70.9) + 6.25(180.3)- 5(35) + 5
BMR= 709 + 1126.875 – 175 + 5
BMR= 1665.875 = 1665.88 kcals * AF * IF
1665.88 * 1.2 * 1.2-1.4 = 2398.87 – 2798.68 kcals/day rounded to
2400 – 2800 kcals/day
After finding the BMR of the pt using Mifflin-St. Jeor equation, activity factor and injury factors were taken into account to find the estimated kcal needs. The pt is bedridden so his activity factor is 1.2, and he has a skeletal injury, so his injury factor is 1.2-1.4.
Protein Needs (NTP pg 168 table 9.5)
1.2 – 1.5g needed for injured pt's and 0.8-1 g needed for regular. Pt has skeletal injuries.

1.2-1.5g/kg.
70.9kg * 1.2-1.5= **85 – 106g/day**
Due to wound healing, the pt's protein needs should be elevated to 1.2-1.5 g/kg/day.

Fluid Needs (PR pg 44)
1mL/kcal
1mL * 2400-2800kcals = **2400-2800 mL/day**
The general fluid needs per day should equal the caloric needs per 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)

1. Increased protein to promote wound healing, and muscle mass maintenance (lean body mass maintenance)
2. Adequate macro and micronutrients to bring pt's nutritional status to normal
3. Adequate caloric intake for body weight maintenance

TwoCal HN because it meets the protein concentration the patient needs (meets 14%-17% range)
http://static.abbottnutrition.com/cms-prod/abbottnutrition.com/img/Therapeutic.pdf

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)

Pt need 85-106g protein/day and 2400-2800 kcal/day
Enteral formula provides 19.9g PRO/237mL and 2kcal/mL

Protein
19.9g/237mL = 85g/X mL
X= **1012.3 mL** OR
19.9g/237 mL = 106g/X mL
X = **1262.42 mL**
1012.3 mL ~ 1262.42 mL needed
kCal
2400-2800 kcal / 2kcal per mL = **1200-1400 m**L needed.

Based on these calculations, it should be around **1200 mL ~ 1262 mL** formula.

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

1200mL~1262mL / 24hrs = **50mL/hour ~ 52.58mL/hour**

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)

No it is not adequate. His fluid needs are 2400mL – 2800mL.
The formula provides 166mL for 237mL.

(166mL/237mL) *1200mL = **840.5 mL** provided.

2400 mL ~ 2800mL - 840.5 mL = **1559.5mL ~1959.5 mL** need to be added by water flushes, dilution of PN formula, or saline solution can be administered with an IV.

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

1. **Albumin** and (3.) **prealbumin** levels - to monitor if his protein supply is sufficient, and measure and monitor his inflammation from his accident.
2. **Hemoglobin** levels to see if he has any internal bleeding present since there is a chance that he has internal bleeding from his MVA.

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

Urine creatinine test measures the amount of creatinine in urine. It reflects the muscle breakdown of the body. We should measure this value because we want him to build muscle and use it for his wound healing and not break down muscle. Too much creatinine will show that he is breaking down muscle to use it as energy, so we should adjust his EN solution to a higher protein concentration so he won't be breaking down muscle.

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)

(NC-2.3) Inadequate enteral nutrition infusion r/t acute pancreatitis AEB diarrhea and pain from not tolerating enteral feedings.

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

I would recommend peripheral PN because it is generally less risky and invasive than central PN. Central PN would be appropriate if the pt was critically ill and was in need of nutrients right away because s/he was severely malnourished. The pt is not severely malnourished, so he does not need to risk getting central PN. He also has no fluid restrictions from kidney, cardiac, and renal failure, so peripheral PN would suit him.

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)

2600 kcal * 0.2 = 520 kcal
520 kcal / 11 kcal/gm = 47.27 g
520 kcal / 1.1 kcal/mL = 472.72 mL round up to **500 mL of 10% lipid solution** (standard bag size)

Check
500 mL of 10% soln = **50 g fat**

50 g * 11 kcal/g = 550 kcal/2600 kcal = **21.2%**, which is around 20%

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 / 2000 mL) x 100% = 5.5% amino acid solution, round up to **6% amino acid 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)

110 g protein x 4 kcal/g = 440 kcal
50g lipid x 11 kcal/g = 550 kcal
440 kcal + 550 kcal = 990 kcal from protein and lipid
2600 kcal – 990 kcal = **1610 kcal from CHO**
1610 kcal dextrose/3.4 kcal/g dextrose = **473.5 g dextrose**

c) Determine the final dextrose concentration of the solution. Show calculations. (2 pts)

473.5 g/2000 mL * 100% = **23.7% dextrose soln**

d) If the PN solution had to be made from a starting stock solution of $D_{50}W$ (500 g dextrose in 1 L of water), what volume of this stock $D_{50}W$ would be needed to provide the grams of dextrose that you calculated in question 9b above? Show calculations. (2 pts)

473.5g dextrose/500 g dextrose x 1L = **0.95 L**.

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)

473.5 g dextrose / 70.1 kgBW = 6.7 g/kg BW
6.7 g/kg BW / 1440 mins per day = 0.00465 g/ kg BW/ min or **4.7 mg/kg BW/min**
No he would not need to change it. It is within range because it is less than 5 mg/kg BW/min.

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

1. **Blood Glucose Level**- because the patient is on PN he may be at risk for hyperglycemia.
2. **Electrolyte level**- Since it is common for an imbalance to occur under PN, we should check it frequently. It helps us check to see if the osmolality and the drip rate of the PN solution is accurate for him. Electrolyte imbalance can lead to neuromuscular and metabolic problems, so it is important for the patient to get the right formula.
3. **Micronutrients** – to see if he is getting adequate micronutrients from PN for wound healing and overall good nutrition.

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)

1. Give him insulin through an insulin pump to keep his blood glucose level under control.

2. Change formula of the PN to a one that has a lower dextrose (CHO) concentration.

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 is a condition that may happen to a severely wasted patient who gets nutrition repletion. The rapid influx of nutrients can lead to fluctuations in electrolytes and fluid level that is so severe, it can lead to neuromuscular and metabolic diseases. The electrolyte imbalances can be due to the rapid shifts of electrolytes into the intracellular cell. Fluid imbalances can be due to the sudden high levels of carbohydrates infusion which will stimulate insulin and promote sodium and water retention. The water retention can cause weight gain and extracellular fluid overload complications. These high nutrient and fluid infusions can also lead to edema (pooling of fluids in peripheral extremeties). High level carbohydrate infusion can lead to hyperglycemia. And the sudden shift of potassium into the intracellular cell can lead to the risk of hypokalemia. Overall, the overload of nutrients to a severely malnourished patient can lead to many complications.