Case Study 4-Trauma
MNT II
5/1/13

By : Sheilah Winter
Client name: Juan Perez

DOB: 3/22

Age: 29

Sex: Male

Education: High school diploma

Occupation: Convenience store clerk

Hours of work: Varies; primarily the night shift, 11 PM to 7 AM

Household members: Lives with his brother, his brother's wife, and their two children ages 2 and 4

Ethnic background: Hispanic

Religious affiliation: Catholic

Referring physician: Deborah Kuhls, MD

Chief complaint:

The patient was brought into the emergency room by a friend after he had been shot in the abdomen.

He was vomiting blood, and complained of severe back and “stomach” pain. He was able to respond to a few questions initially but stated the pain “was too bad for me to think.” He denied being allergic to any medications or having any chronic medical problems.

Patient history:

Onset of disease: Brought into the ER by a friend at 2 AM yesterday vomiting blood, and with obvious bleeding wounds from abdominal area.

PMH: Unremarkable

Meds: None
Smoker: Yes

Family Hx: What CAD Who? Unknown

Physical exam:

General appearance: Mildly obese 29-year-old Hispanic male on mechanical ventilation

Vitals: Temp 102.6°F, BP 115/65 mm Hg, HR 135 bpm/normal, RR 20 bpm

Heart: Noncontributory

HEENT: NG tube in place for decompression

Rectal: Not done

Neurologic: Sedated

Extremities: 4+ bilateral pedal edema noted

Skin: Warm, moist

Chest/lungs: Lungs clear to auscultation and percussion

Peripheral vascular: Pulses full—no bruits

Abdomen: Abdominal distension, wound VAC in place, three tubes draining peritoneal fluid, hypoactive BS present in all regions. Liver percusses approx 8 cm at the midclavicular line, one fingerbreadth below the right costal margin.

Nutrition Hx:

General: Weight obtained from patient’s brother who stated that patient usually weighs about 225 lbs,

height 5’10”, and has not lost or gained a significant amount of weight recently. He denies that his brother follows any special diet. Reports that his brother usually drinks “several beers” every night, more on the weekend.

Dx:

Abdominal GSW

Tx plan:
He was immediately taken to surgery where he underwent an exploratory damage-control laparotomy, gastric repair, control of liver hemorrhage, and resection of proximal jejunum, leaving his GI tract in discontinuity.

Hospital course:

After surgery, the patient was transferred to the Trauma Intensive Care Unit and maintained on mechanical ventilation. He returned to surgery on hospital day 2 to remove packs, and to reestablish bowel continuity. An abdominal vacuum-assisted closure (VAC) device was placed. Three Jackson-Pratt drains were left in place. On hospital day 3, the patient was taken back to surgery where an anastomotic leak was detected. A gastrojejunostomy tube was inserted through the patient’s stomach, with the jejunal limb shortened in order to provide antegrade intraluminal drainage, as well as a retro-grade jejunostomy tube for drainage. On hospital day 7, the patient was again taken to surgery for an abdominal washout, insertion of a distally placed J-tube for feeding, and a VAC change. The patient subsequently returned to the OR for multiple washouts and reapplication of a wound VAC. Nutrition consult was ordered by the trauma surgeon after this initial surgery on hospital day 1.

As per the clinical RD’s recommendations, total parenteral nutrition (TPN) was initiated on hospital day 2 with dextrose 300 g and amino acids 170 g per day. Lipid emulsions were not recommended at this time. Although the patient was determined to have good nutritional status prior to his admission, he was now assessed to be at high nutritional risk due to the need for mechanical ventilation, large wounds, fluid and electrolyte losses, altered GI function, and the need for parenteral nutrition support. Energy needs were determined based on the patient’s usual weight, rather than the current weight of 110 kg, due to the significant amount of generalized anasarca noted. The patient’s medications included morphine, lorazepam, propofol @ 35 mL/hr, esomeprazole, meropenum, and vancomycin. A metabolic cart measurement was obtained on hospital day 4, which revealed the following: REE 3657 RQ 0.76. Blood glucose levels ranged from 107–185, and patient was placed on the insulin drip protocol. Dextrose was increased in the TPN to 350 g, and amino acids were increased to 180 g. On hospital day 10, the propofol was discontinued, and a second metabolic cart was obtained (REE 3765 RQ 0.70). At this point, IV lipids were added (250 mL three times per week). Blood glucose levels ranged from 110–145. Triglyceride levels were less than 400 mg/dL. Enteral nutrition support (Crucial with 1.5 calories per mL and 94 g of protein per liter) was initiated on hospital day 11 utilizing the jejunostomy tube at 10 mL/hr. On hospital day 12, the enteral nutrition formula was advanced to 15 mL/hr, and on hospital day 13, it was advanced to 20 mL/hr, at which point it was noted that enteral formula was draining from the anastomotic leak, and the enteral feeds were decreased to
1. The patient has suffered a gunshot wound to the abdomen. This has resulted in an open abdomen. Define open abdomen.
Abdomen is not closed, instead sterile dressing is applied leaving abdominal cavity exposed. They open the abdomen to allow for swelling with abdominal injury or surgery. Fluid and protein are lost with open abdomen and there is a 30% increase in mortality. There is a greater chance for infection with an open wound as well.

2. The patient underwent gastric resection and repair, control of liver hemorrhage, and resection of the proximal jejunum, leaving his GI tract in discontinuity. Describe the potential effects of surgery on this patient’s ability to meet his nutritional needs.
Because this patient was well nourished before surgery he should tolerate the surgery better. However, all patients who undergo surgery will be in a catabolic state meaning they will need more calories and protein. Due to the open abdomen Mr. Perez is also at risk increased fluid and protein losses. The Gastric resectioning removed part of the stomach and then part of the jejunum was removed as well. The jejunum is the greatest site for nutrient absorption. This will put him at risk for malabsorption of macronutrients such as fats, carbs and protein, as well as micronutrients such as Vitamin C, thiamin, Vitamin B2, Vitamin B6 and folic acid. The stomach is in charge of churning the food and partially digesting it so it can be absorbed, motility will be decreased but if the gut still works use it. So the guts still needs to be stimulated so it doesn’t atrophy. The liver hemorrhage most likely cause a lot of blood loss, as well as blood lost in the surgery so he could be anemic. Other concerns with the liver hemorrhage is that the liver is in charge of producing and excreting bile. Without this bile the patient could have decreased fat absorption and decreased absorption of fat soluble vitamins (A, D, E, and K). The liver also stores many nutrients such as glucose, vitamin A,D,E, K, B12, iron, zinc, copper and magnesium, so these nutrients should be monitored.

3. Complications for this patient included anasarca. Define anasarca and describe how this condition may affect interpretation of his nutritional status.
Anasarca is an accumulation of fluid buildup in the tissues that cause severe edema. Edema could affect interpretation of his nutrient status because lab values could be false and diluted. Anasarca is often caused by liver failure.

4. The metabolic stress response to trauma has been described as a progression through three phases: the ebb phase, the flow phase, and finally the recovery or resolution. Define each of these and determine how they may correspond to this patient’s hospital course.
The Ebb phase is immediately after surgery for the first 36 hours where there is hypovolemia, shock and tissue hypoxia. In this phase there is decreased cardiac output, decreased oxygen consumption, lowered body temperature, and decreased insulin levels because glucagon is elevated. The main goal for this phase is to get the patient hemodinamically stable. For this patient the Ebb phase was the abdominal distension, temperature of 102.6 degrees, blood pressure of 115/65, normal heart rate of 135bpm and clear lungs. He was put on TPN with dextrose and amino acid but no lipids.
The **Flow** phase is after the **Ebb** phase and can last weeks. During this phase there is fluid resuscitation, restoration of oxygen transport, increased cardiac output, increased body temperature, increased energy expenditure, total body catabolism, increased glucose production (uses AA to make glucose), FFA released, and circulating insulin. For Mr. Perez he was put on a ventilator, had a temperature, a gastrojejunostomy tube was inserted to provide intraluminal drainage. His dextrose and protein were increased in his TPN due to increased protein catabolism and increased energy expenditure.

The **Recovery** phase is 10 to 60 days after injury. In this phase begins the rebuilding anabolic phase. During this phase the insulin and hormone levels go back to normal, lean body mass starts to rebuild and blood glucose goes back to normal. This phase can be repeated in there is multiply injuries. Because of his many surgeries Mr. Perez had to repeat this response phase many times. For Mr. Perez his blood glucose levels went back to normal and his triglycerides were less than 400mg/dl and Enteral nutrition was administered.

5. **Acute phase proteins are often used as a marker of the stress response.** What is an acute phase protein? What is the role of the C-reactive protein in the assessment of critically ill trauma patients?

Acute phase proteins are made in the liver and are used to evaluate the status of a trauma patient. These proteins have plasma that increase or decrease as a response to inflammation. Positive acute phase proteins such as C-reactive proteins and alpha-1-antitrypsin increase with inflammation. Negative acute phase proteins, such as albumin and prealbumin, decrease during injury. C-reactive protein can indicate inflammation or infection in trauma patients and can show when the patient has moved to recovery phase. Generally, C-reactive proteins will increase in the Ebb phase and decreased in the recovery phase.

6. **Metabolic stress and trauma significantly affect nutritional requirements.** Describe the changes in nutrient metabolism that occur in metabolic stress. Specifically address energy requirements and changes in carbohydrate, protein, and lipid metabolism.

In metabolic stress the body is in a catabolic state and is breaking down protein and muscle which puts the body in negative nitrogen balance. Nutrition requirement change as the patient goes through the different phases. In the Ebb phase the main concern to maintain oxygen delivery and to get hemodynamically stable. In the flow phase calorie requirements are increased as well as protein. Calorie requirement should start at 30kcal/kg and be adjusted from there. Protein should be 1.2-2g/kg. For lipid there the formula used should have medium chain triglycerides that are easily digested. We don’t want any fiber in trauma patients because we don’t want to slow down transit anymore than it already is. Fluid and electrolytes should be monitored. There is also an increased need for B vitamins, zinc, magnesium, potassium and phosphorus because of lean body mass losses.

7. Are there specific requirements that should be considered when designing nutrition support for a trauma patient? Explain the rationale and current recommendations regarding glutamine, arginine, and omega-3 fatty acids for this patient population.

Trauma patients need increased calories and protein due to the protein losses in lean body mass. The recommendations are anywhere between 1.2-2g/kg. There is also an increased need for Thiamin, Niacin, Zinc, Magnesium, Potassium, Phosphorus from lean body mass as well. Too much fiber is not recommended for trauma patients because we don’t want to slow down transit because gut motility is already slowing. Trauma patients need arginine and glutamine to help maintain and rebuild lean body mass. Glutamine is recommended because
it is an amino acid that decreases gut inflammation and gut permeability. Arginine is important because it promotes protein synthesis and wound healing. These amino acids will also help prevent muscle break down and catabolism. Lastly, antioxidant and omega 3 fatty acids are also recommend. Both omega 3 fatty acids and antioxidants reduce inflammation which is also very important in a trauma patient. Formulas that are used for this population of patients include Pivot or Oxepa. These formulas include MCT, BCAA, arginine, glutamine, omega 3 fatty acids and fiber. Pivot is an immune enhancing formula.

8. Explain the decision-making process that would be applied in determining the route for nutrition support for the trauma patient.

When determining the nutrition support for a trauma patient we must first wait until the patient is hemodynamically stable. Once this happens then we need to determine the calorie and protein needs of this patient to then initiate enteral tube feeding. By starting enteral tube feeding this will stimulate the gut preventing bowel obstruction, or ileus. An NG or an OG tube is recommended for short term tube feeding to get the gut moving. Usually a trickle feed starting at 10ml/hour is the rate that is started and then 10 mls are added each hour as tolerated until goal tube feeding is met. If the patient has an open abdomen then an NJ tube is placed. If the patient is not tolerating the tube feeding the NPO is recommended for 5-7 days with TPN. Patients needs vary depending on injury, weight, and other factors so using clinical judgment is best. Mr. Perez is NPO so he will not be able to meet his calorie needs orally or through enteral nutrition so he will need TPN.

9. What factors make assessing his weight difficult on a daily basis?

Factors that could make assessing his weight difficult include Anasarca (edema) or fluid losses. In the Ebb phase the patient has lost a lot of fluids causing a lower body weight. Once in the flow phase fluids are recovering and edema could cause swelling and alter the weight to look more than it actually is. In addition patient is in a catabolic stage at this point and losing LBM so weight could be shifting a lot. Other complications include transferring the patient to zero the bed scale to get an accurate weight.

12. What are the indications for obtaining a metabolic cart (indirect calorimetry) for this patient?

Indirect calorimetry measure the REE of the patient which determines the energy that patient needs. It is determined by the amount of oxygen used divided by the carbon dioxide being produced. This gives a respiratory quotient. Indications that an indirect calorimetry is needed is in severe trauma patients, kids, and elderly. If a patient is not getting enough calories then IC should be used, or if the patient is ventilated to make sure the are getting enough oxygen so they can get off the ventilator as soon as possible. IC is the gold standard in all trauma patients.

13. Compare the estimated energy needs calculated using the predictive equations with each other and with those obtained by indirect calorimetry measurements.

The indirect calorimetry showed that Mr. Perez’s REE was 3657 with an RQ of 0.76 meaning that he was not getting enough calories on day 4. On day 10 his REE was 3765 with an RQ of 0.70 so he still was needing more calories. 
Ireton Jones: 2459.9 kcal (calculated online @ http://www.globalrph.com/ireton-jones-equations.cgi)
Pen State: 2525kcal (calculated online)
Mifflin: (10 x 102) + (6.25 x 178) – (5 x 29) + 5 = 1992cal x 1.4 injury factor = 2,788cal
Harris Benedict: 66 + (13.7 x 102) + (5 x 178) – (6.8 x 29) = 2090cal x 1.4 = 2926kcal

All the predictive equations were much less than the REE obtained from the IC. This shows that IC was the correct method for calorie needs, underfeeding the patient could make him malnourished and make his hospital stay longer. Although it should be taken into consideration that this patient is also obese and permissive underfeeding could be ok as long as protein needs are high.

14. Interpret the RQ values. What do they indicate?
RQ is the carbon dioxide production divided by the oxygen consumption of the patient which measure whole body oxygen. An RQ of 0.85 is the best and implies mixed substrate utilization. An RQ lower than that indicated that the patient is not getting enough calories. An RQ higher than that indicated excessive CO2 production meaning they are being overfed. If this happened then the patient has increased respiratory demands and the RD should decrease calories and carbohydrates. Mr. Perez shows that he is being underfed according to his RQ of 0.70.

15. What factors contribute to the elevated energy expenditure in this patient?
Factors that contribute to the elevated energy expenditure are his injury from the gun shots, his wound healing, his surgeries of laparotomy, gastric repair, control of liver hemorrhage and resection of proximal jejunum and his high BMI. Fever and his respiratory rate could also have some influence.
16. Mr. Perez was prescribed parenteral nutrition and was to receive 300 g of dextrose and 170 g of amino acids per day. Determine how many kcals and grams of protein are provided with this prescription. Read the patient care summary sheet. What was the total volume of PN provided that day?

\[300 \text{g dextrose x 3.4 = 1,027; 170g AA x 4 = 680}\]
\[1027 + 680 = 1,707 \text{kcals}\]

\[\text{Propofol = 35ml/hr = 35 x 1.1 = 38.5 x 24hrs = 924}\]
\[1,070 + 924 = 1,994 \text{kcals (including propofol)}\]

17. Compare this nutrition support to his measured energy requirements obtained by the metabolic cart on day 4. Based on the metabolic cart results, if he were able to tolerate tube feeding, what tube feeding product would you recommend? Starting rate? Tube placement? Goal rate? Total fluid, calories and protein provided by tube feeding at goal rate?

His carts show that his REE on day for was 3657 kcals which is much lower than the 1,994 kcals administered to him from PN. If he could tolerate tube feeding I would recommend Pivot 1.5 because it is a high calorie and high protein formula that is immune enhancing. The hospital recommended Crucial 1.5 with 94g of protein per liter, which would also work good and has a higher protein value. I would start at 10mls per hour and then increase from there based on what was tolerated. The placement of the tube should be an NG tube because this patient is ventilated so oral is not an option.

\[3765 \text{REE – 924 (propofol)= 2,841 kcals needed} \]
\[110kg x 1.5 = 165 \text{g protein}\]

Fluid: 35cc x 110 = 3850cc
\[2,841/ 1.5= 1,894/ 24hrs= 80ml/ hr\]

Protein : 1.9 L x 94g= 178g protein

Goal: Crucial 1.5 at 80 mls/hr; provides 2,880 kcals and 178g protein and 1,900ml fluids (will need IV for fluids)

18. The patient was also receiving propofol. What is this, and why should it be included in an assessment of his nutritional intake? How much energy did it provide?

Propofol is a drug that is used for sedation and is just like Diprovan. It is given through an IV in a lipid solution that is 1.1 cals/ml. For Mr. Perez Propofol was given at 35 ml/hr and accounted for 924 of his calories. This is important to include in calorie intake because if not accounted for this patient could get overfed and result in too much CO2 production. Too much CO2 production could cause the patient to be ventilated longer.
19. On day 11, the patient started on an enteral feeding. If his nutrient needs were met by parenteral nutrition, why was enteral feeding started?
Enteral feeding is started to stimulate the gut and get it moving. This prevents the gut from atrophying. PN can still be administered if needs are not completely met by EN.

20. This patient received the formula Pivot 1.5. What type of enteral formula is this? Why was this type of formula used? How many kilocalories are being provided by enteral nutrition support and what percent of his total nutritional intake does this represent?
This patient was given Crucial 1.5. Crucial is a formula used for critically ill patients or patients with severe trauma. This formula provides a high concentration of proteins and provides immune support. In the formula is omega 3 fatty acids, antioxidants, and areginine which are important for trauma patients. Mr. Perez was receiving 15ml/hr. 
15ml x 24hr= 360 ml x 1.5= 540 kcals which is 14% of 3765 REE
TPN was increased to 20ml/hr but was not tolerated so moved back down to 15.

21. From the information gathered within the intake domain, list possible nutrition problems using the appropriate diagnostic term.
Nutrition problems are increased energy expenditure (NI-1.1), Increased Nutrient needs (NI-5.1), Inadequate fluid intake (NI-3.1), Inadequate Enteral Nutrition Infusion (NI-2.3), Malnutrition (NI-5.2)

22. From the information gathered with the intake domain, list the possible nutrition diagnoses.
- Increased energy expenditure (NI-1.1) related to increased nutrient needs as evidence by unintentional weight loss
- Inadequate enteral nutrition infusion (NI-2.3) related to intolerance of EN as evidence by low metabolic cart/ indirect calorimeter measurement.
- Inadequate fluid intake (NI-3.1) related to food and nutrition related knowledge deficit concerning appropriate fluid intake as evidence by estimated intake of fluids less than requirements.
- Increased Nutrient Needs (NI-5.1) related to wound healing as evidence by unintentional weight loss
- Malnutrition (NI-5.2) related to injury/trauma as evidence by loss of muscle
22. List abnormal biochemical values and describe why they might be abnormal.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Normal Value</th>
<th>Patient’s Value (Day 10)</th>
<th>Reason for abnormality</th>
<th>Nutrition Implication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albumin</td>
<td>3.5-5 g/dl</td>
<td>1.9 g/dl (L)</td>
<td>Protein loss</td>
<td>Not getting enough protein</td>
</tr>
<tr>
<td>Total Protein</td>
<td>6-8 g/dl</td>
<td>5.1 g/dl (L)</td>
<td>Open abdomen, wound healing, trauma, surgery, GI bleeding, protein catabolism</td>
<td>Break down of LBM</td>
</tr>
<tr>
<td>Osmolality</td>
<td>285-295 mmol/kg/H2O</td>
<td>305 mmol/kg/H2O (H)</td>
<td>Not getting adequate fluids</td>
<td>Indicated dehydration</td>
</tr>
<tr>
<td>Glucose</td>
<td>70-110 mg/dl</td>
<td>140 mg/dl (H)</td>
<td>Liver hemorrhage, elevated in flow phase</td>
<td>Needs to be monitored to make sure pt is not hyperglycemic</td>
</tr>
<tr>
<td>BUN</td>
<td>8-18 mg/dl</td>
<td>25 mg/dl (H)</td>
<td>Open abdomen, wound healing, trauma, surgery, GI bleeding, protein catabolism</td>
<td>Break down of LBM, malnourished</td>
</tr>
<tr>
<td>C-Reactive Protein</td>
<td>&lt; 1.0 mg/dl</td>
<td>220 mg/dl (H)</td>
<td>Elevated with inflammatory response</td>
<td>Indicated when body is no longer in catabolic stage</td>
</tr>
<tr>
<td>TG</td>
<td>40-160 mg/dl</td>
<td>265 mg/dl (H)</td>
<td>Respiratory difficulties, increase circulation of FFA in response phase</td>
<td>Make sure pt is not overfed</td>
</tr>
<tr>
<td>Magnesium</td>
<td>1.8-3 mg/dl</td>
<td>1.5 mg/dl (L)</td>
<td>Loss of LBM</td>
<td>Could indicate malnourished</td>
</tr>
</tbody>
</table>