**Case 34: Closed Head Injury: Metabolic Stress with Nutrition Support**

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*1. What is the Glasgow Coma Scale (GCS)?*

The Glasgow Coma Scale is a diagnostic measure that is used to evaluate and rank the severity of a traumatic brain injury (Nelms, 623). When using this scale the motor response, verbal response, and eye opening response are ranked on a scale of 3 to 15, with 3 being the most severe coma level and and the 15 being the least severe coma level. In general, the head injury classification is as follows severe head injury is a GCS of less than 8, a moderate head injury is a GCS score of 9-12, and a mild head injury is a GCS score of 13-15 (Nelms, 623).

*2. What was Chelsea’s initial GCS score? Is anything in the initial physical assessment consistent with this score? Explain.*

Chelsea’s initial GCS score is 10 E4 V2 M4. A score of a 10 indicated that she has moderate injury. A score of E4 rates her eye-opening response which indicated that it was spontaneous and opened with blinking at baseline. The score of V2 rates her verbal response which indicated she had incomprehensible speech. A score of M4 rates her motor response which indicated she only withdrawals in response to pain (Nelms, 623). Based upon the initial physical assessment these scores are consistent with Chelsea’s evaluation starting that she was alternating between crying and unconsciousness. Also looking at her eyes her reactive and opened to 4 mm and had no battle or raccoon signs. Also it was noted she did not have any verbal responses and withdrew and moaning when she was touched

*3. Define the following terms found in the admitting history and physical:*

 *a. Intensivist:* A board certified physician who provides special care for the the critically ill patients. The intensivist has advanced special training and experience in treating more complex types of patients. The areas of advanced special training include surgery, internal medicine, pulmonary medicine or pediatrics (UMass Memorial Medical Center, 2016).

 *b. L-sided hemiparesis:* weakness on the left side of the body. The patient is still able to move the affected side but has reduced muscular strength (National Stroke Association, 2016).

*4. Read the CT scan and MRI report. The CT scan report was very general, noting density in the frontal lobe. The MRI indicated more localized areas of edema and blood in the frontal lobe. It also discusses a shearing injury.*

 *a. What causes edema and bleeding in a traumatic brain injury?*

When there is traumatic brain injury it can be classified as either penetrating or close-head injury. IN a penetration head injury this involves the penetration of the skull and direct damage to the brain tissue (Nelms, 622). Both edema and bleeding from a traumatic brain injury are considered secondary injuries that occur due to the physiological changes that occur during the aftermath of the initial injury. These secondary injuries can adversely affect brain function (Nelms, 622).

*b. What general functions occur in the frontal lobe? How might Chelsea’s injury affect her in the long term?*

The general functions that occur in the frontal lobe of the brain includes integrating all components of behavior along with emotion, social adjustment, and impulse control. In general Chelsea’s long term speech could be negatively affected, she may experience personality change, social rules of behavior may change (Brain Injury Alliance, 2016). Additionally, her executive functions could all be affected including planning, abstract reasoning, impulse control, and attention (Brain Injury Alliance, 2016).

*5. What factors place the patient with traumatic brain injury at nutrition risk?*

The factors that place the patient with traumatic brain injury at nutrition risk is that brain injury results in systemic inflammatory response. This is a metabolic and inflammatory response results from hypermetabolism, hyperglycemia, insulin resistance, increased gluconeogenesis, lipolysis and protein wasting (Nelms, 623). It is important to be timely in providing enteral or parenteral nutrition to patients because if they are not aggressively supported they can lose up to 15% of their body weight in one week (Nelms, 623).

*6. Chelsea’s height is 132 cm, and her weight on admission is 27.7 kg. At 9 years of age, what is the most appropriate method to evaluate her height and weight? Assess her height and weight.*

Since Chelsea is only 9 years old the most appropriate way to evaluate her height is using the female aged 2-20 years old for stature-for-age and weight-for-age growth chart. Also the girls BMI-for-age growth chart can be used to evaluate her BMI. For her height she is in the 50th percentile. For her weight she is in the 45th percentile.

BMI= kg/ m2

BMI= 27.7 kg/ (1.32 m2)

BMI= 15.6 kg/ m2

Based on the BMI-for age growth chart she is 40th percentile for being 9 years old and therefore she is in the healthy weight category (CDC, 2016).

*7. What method should you use to determine Chelsea’s energy and protein requirements? After specifying your method, determine her energy and protein needs.*

**EER for Girls 9 Through 18 Years**

EER = 135.3 – (30.8 × age [y]) + PA × (10.0 × weight [kg] + 934 × height [m]) + 25 kcal

PA = 1.00 if PAL is estimated to be ≥ 1.0 < 1.4 (sedentary)\*

PA = 1.13 if PAL is estimated to be ≥ 1.4 < 1.6 (low active)

PA = 1.26 if PAL is estimated to be ≥ 1.6 < 1.9 (active)

PA = 1.42 if PAL is estimated to be ≥ 1.9 < 2.5 (very active)

The most appropriate method that should be used to evaluate Chelsea’s energy needs are to calculate her estimated energy needs for females ages 9-18 years old. (Nutrition Through the Life Cycle, 352).

EER = 135.3 – (30.8 × 9) + 1.5 × (10.0 × 27.7 kg + 934 × 1.32 m) + 25 kcal

EER = 135.3 – (277.2) + 1.5 × (277 + 1,232.88) + 25 kcal

EER = 135.3 – (277.2) + 1.5 × (1,509.88) + 25 kcal

EER = 135.3 – (277.2) + 2,264.82 + 25 kcal

EER = 2,147.92

EER = 2,100- 2,200 kcals

Protein Needs

Based on the DRI, the recommended protein intake for school age children from age 4-13 years old is 0.95 gram of protein per kg of body weight (Nutrition Through the Life Cycle, 325). Since Chelsea has a TBI her protein needs are increased to 1.5 g/kg – 2.0 g/kg per day (Nutrition in Clinical Practice, 2010)

1.5 g/kg x 27.7 kg= 41.55 grams

2.0 g/kg x 27.7 kg= 55.40 grams

Range= 42-55 grams of protein per day

*8. Chelsea was to receive a goal rate of Nutren Jr with fiber @ 85 cc/hr. How much energy and protein would this provide? Show your calculations. Does it meet her needs?*

Nutren Junior has 1.00 kcal/ mL, 30 g/L PRO, 110 g/L CHO, 50 g/L Fat (Appendix C2 Parentral Formulas)

85 cc/hr x 16 hr= 1,360 cc/ day= 1.36 L/ day (1,360 mL/day)

Energy Needs

1.00 kcal/mL x 1360 mL/ day = 1360 kcal/day

If Chelsea receives this amount of Nutren Jr. she will receive significantly under her EER of 2,100-2,200 kcals/ day.

Protein Needs

30 g/L x 1.36 L/day = 40.8 grams protein

If Chelsea receives this amount of Nutren Jr. She will receive slightly under her needs of protein of 42-55 grams of protein per day.

*9. Using the patient care summary sheet, answer the following:*

 *a. What was the total volume of feeding she receive on June 5?*

85 cc/hours x 18 hours = 1530 cc

1530 cc + 50 cc in the 23rd= 1580 cc

*b. What was the nutritional value of her feeding for that day? Calculate the total energy and protein.*

1580 cc -> 1580 mL -> 1.58 L/day

Total Energy:

1.00 kcal/mL x 1580 mL/ day = 1580 kcal/day

Total Protein:

30 g/L x 1.58 L/day = 47.4 grams protein

*c. What percentage of her needs was met?*

Total Energy Needs: 2,100- 2,200 kcal

(1,580 kcal/ 2,150 kcal) x 100 = 73%

Total Protein Needs: 42-55 grams

(47.4 grams/ 48.5 grams) x 100 = 98%

*d. There is a note on the evening shift that the feeding was held for high residual. What does that mean?*

Residual means fluid or contents that remains in the stomach when doing a PEG tube feed. It is important to check for residuals and this done using a syringe and pulling back the plunger to withdraw stomach contents, reading the amount in the syringe and then injecting the contents back into the syringe (Shepard Center, 2016).

*e. What is aspiration? What are the potential consequences?*

Aspiration means to draw in out using a sucking motion which can result breathing in a foreign object into the airway or into the lungs (Medline Plus, 2014). A variety of things can be inhales including food, fluid, medication, saliva, gastric contents, bacteria or other foreign objects (Developmental Disabilities Resources, 2006). Sings of aspiration include coughing, choking, shortness of breath of the patient (Shepard Center, 2016). The consequences of aspiration depend on the type of material aspirated, its volume and the pH. Possible complications include pneumonia, lung abscess, hypertension, pulmonary tree damage, decline in arterial blood oxygen, interstitial edema (Developmental Disabilities Resources, 2006).

*f. What is the usual procedure for handling a high gastric residual? How do you think Chelsea’s situation was handled?*

The usual procedure for handling a high gastric residual is to monitor the individual for excessive gastric residual volume. Excessive gastric residual volume is defined as 100 mL or 1.5 times the hourly rate. Gastric residual should be checked every 4 to 6 hours and feedings held for 1 hours if the RV is 1.5 times the hourly rate (Outreach Services of Indiana, 2009). If the excessive gastric residual volume is determined the feeding should be held and a gastrointestinal evaluation should be completed and discuss the finding with the team (Outreach Services of Indiana, 2009). In Chelsea’s situation, as recommended the feeding should have been held and evaluation was completed and discussed with the entire team.

*g. What other information would you assess on the daily flow sheet to determine her tolerance to the enteral feeding?*

The other information on the daily flow sheet that would be used to determine the tolerance of the enteral feeding is monitoring her total inputs which include the tube feed and any other fluid from an IV. Also her outputs should be evaluated to compare them to her inputs. Other areas that should be included in a daily flow sheet include:

* Sufficiency of nutrient intake: intake/ output
* Electrolytes, BUN, and creatinine
* Magnesium, phosphorus, calcium
* Liver function tests
* Triglycerides
* Weight
* Hydration/ fluid status: physical assessment of skin turgor, presence of edema, temperature; oral cavity for color, texture, moisture/ dryness
* Vital signs: blood pressure, respirations, pulse
* Bowl function
* Blood glucose
* Nitrogen balance (Nelms, 101)

*h. Look at the additional information on the patient care summary sheet. Are there any factors of concern? Explain.*

Additional information on the patient care summary sheet that would be of concern is that she only had 1 soft bowel movement and nothing else was noted in the chart. This could indicate that she did not tolerate the enteral feeds. Additionally, when looking at her weight, it changed very minimally but this could have been from fluid. Her weight should be continued to be monitored but it is not of concern. Additionally, vital signs should be monitored daily which includes blood pressure, respiration and pulse. A low blood pressure is indicative of enteral nutrition intolerance, so this is very important to monitor (Nelms, 101).

*10. Evaluate Chelsea’s laboratory data. Note any changes from admission day labs to June 3. Are any changes of nutritional concern?*

|  |  |  |
| --- | --- | --- |
| **Lab Value** | **Day 1 on 5/24** | **Day 10 6/3** |
| Albumin | 3.7 g/dL | 3.3 g/dL |
| Potassium  | 3.9 mmol/L | 3.6 mmol/L |
| Chloride | 110 mmol/L | 113 mmol/L |
| Sodium | 142 mmol/L | 139 mmol/L |
| Osmolality | 286 mmol/ kg H2O | 279 mmol/ kg H2O |
| Glucose | 189 mg/dL | 115 mg/dL |
| BUN | 6 mg/dL | 4 mg/dL |
| Calcium  | 8.5 mg/dL | 9.2 mg/dL |

Based on the laboratory data her albumin is low which is an indication of the visceral protein status. Albumin status here reflect illness and not necessarily decreased nutritional status (Nelms, 58). The change in potassium, chloride, sodium, and osmolality are all due to her dehydration status when being admitted with the TBI. Chelsea’s glucose levels are higher upon admittance because of the hypermetabolic response to stress with the TBI (NIH, 2009). It has been shown that with intensive care unit her glucose levels are controlled (NIH, 2009).

*11. On June 6, a 24-hour urine sample was collected for nitrogen balance. On this day, she received 1650 cc of Nutren Jr. Her total nitrogen output was 14 grams.*

 *a. Calculate her nitrogen balance from this information. Show all of your calculations.*

1650 cc -> 1,650 mL of Nutren -> 1.65 L/day

30 g/L x 1.65 L/day= 49.5 grams of protein

N2 Balance= [(dietary protein intake)/ 6.25] – urine urea nitrogen – 4 (Nelms, 58)

N2 Balance= [(49.5 grams)/ 6.25] – 14 grams – 4

N2 Balance= 7.92 grams – 14 grams – 4

N2 Balance= -10.08 grams

*b. How would you assess this information? Explain your response in the context of her hypermetabolism.*

Based on the nitrogen balance calculation Chelsea has a negative nitrogen balance which develops when nitrogen excretion is greater than nitrogen excretion is greater than nitrogen intake indicating catabolism ore inadequate nitrogen intake (Nelms, 57). Measuring nitrogen balance assesses overall protein status in critical care. Nitrogen balance is measured in urine collection, wounds, burns, diarrhea and vomiting (Nelms, 58). Due to her traumatic brain injury her body is in the state of hypermetabolism and stressed form the trauma. Chelsea’s body has an increased metabolic rate and protein synthesis to heal damaged tissues which reflects a negative nitrogen balance (NIH, 2010).

 *c. Are there any factors that may affect the accuracy of this test?*

The factors that may affect the accuracy of this test are the error of the 24-hour urine collection and the failure to account for renal impairment and inability to measure loss of nitrogen from wounds, burn, diarrhea and vomiting (Nelms, 58). Also it is difficult to measure nitrogen intake if the patient is not exclusively on enteral or parenteral nutrition support (Nelms, 58).

*d. The intern taking care of Chelsea pages you when he reads your note regarding her negative nitrogen balance. He asks whether he should change the enteral formula to one higher in nitrogen. Explain the results in the context of the metabolic stress response.*

During metabolic stress the body has a much higher rate of gluconeogenesis. This increased rate forces the body to use protein instead of glucose as an energy source. Due to the increased use of protein, the body excretes more nitrogen resulting in a negative nitrogen balance (Nelms 58). This calculation was previously done and was -10.08 grams, which supports this statement. The enteral formula should not be changed to one with a higher nitrogen because research indicates that nitrogen balance is generally not achieved until after the third week (Nelms, 623). Overall the enteral formula should not be altered.

*12. Chelsea has worked with occupational therapy, speech therapy, and physical therapy. Summarize the training that each of these professional receives and what their role might be for Chelsea’s rehabilitation.*

Occupational therapists are health professionals who has obtained a master’s degree and passed a national registration exam responsible for treating injured, ill or disabled patients through the therapeutic use everyday activities in the areas of mental, physical, developmental and emotional health (Nelms, 3). They work to help patients develop, recover and improve the skills they need for daily living and working environments (Bureau of Labor Statistics, 2016). In Chelsea’s rehabilitation they are important in talking with Chelsea and helping her with any trauma she may still have from the car accident and they will assist her with everyday activities as she fully recovers.

A speech pathologist is a health professional who has earned a master’s degree and passed a national examination, who assess, diagnoses, treats, and helps to prevent speech, language, cognitive, communication, voice, swallowing, fluency, and other related disorders (Nelms, 3). Many of the patients that a speech pathologist would be one who had a stroke, brain injury, hearing loss, developmental delay, Parkinson’s disease, cleft palate or autism (Bureau of Labor Statistics, 2016). In Chelsea’s rehabilitation they are important for advancing her diet to an oral diet.

A physical therapists (PT’s) are health professional who have earned a master’s degree and passed an examination who help injured or ill people improved their movement and manage their pain. PT’s are important for the rehabilitation, treatment and prevention of patients with chronic conditions, illness or injuries (Bureau of Labor Statistics, 2016). In Chelsea’s rehabilitation they are important in regaining any strength that she lost while in the hospital since she does play sports. In general first she needs to improve her movement and manage her pain and provide her heat and massages for her to be in less pain.

*13. The speech pathologist saw Chelsea for a swallowing evaluation on hospital day 10. (see p. 395)*

 *a. What is a video fluoroscopy?*

A video fluoroscopy test is one that is able to see what is happening inside of your mouth and throat. This test is able to see if food is going into your airway instead of your stomach, which parts of your mouth and throat may not be working well, what kinds of food are safest for you to swallow, and if certain positions or strategies help you swallow better. The test is completed in the radiology department where the patient is given foods and drinks mixed with barium so it shows up on the test (American Speech-Language-Hearing Association, 2016)

 *b. What factors were noted that support the need for enteral feeding at this time?*

The factors that were noted that support the need for enteral feeding is that Chelsea accepted macaroni and cheese with appropriate tongue lateralization and chewing skills but choked after 5-7 ice chips and reflected oral skills were appropriate. But she showed significant signs of fatigue and decreased cooperation after accepting macaroni and cheese. Based on this fatigue and lack of cooperation this inhibited PO feeding as noted by the speech pathologist.

*14. At Chelsea’s recover proceeds, she begins a PO mechanical soft diet. Her calorie counts are as follows:*

*(10/14)*

*Oatmeal ¼ cup*

*Brown sugar 2 T*

*Whole milk 1 cup*

*240 cc Carnation Instant Breakfast (CIB) prepared with 2% milk*

*Mashed potatoes 1 cup*

*Gravy 2 T*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Food** | **Serving Size** | **CHO (grams)** | **PRO (grams)** | **Fat (grams)** | **Calories**  |
| Oatmeal | ¼ cup | 6 | 1 | 1 | 36 |
| Brown Sugar | 2 Tbsp | 27 | 0 | 0 | 105 |
| Whole Milk | 1 cup | 12 | 8 | 8 | 149 |
| Carnation Instant Breakfast | 240 cc = 1 cup | 32 | 14 | 5 | 223 |
| Mashed potatoes | 1 cup | 45 | 4 | 0 | 193 |
| Gravy | 2 Tbsp | 1 | 0 | 3 | 29 |
| **Total** |  | **123 grams** | **27 grams** | **17 grams** | **735 kcals** |

*(10/15)*

*Cheerios 1 cup*

*Whole milk 1 cup*

*240 cc CIB prepared with 2% milk*

*Grilled cheese sandwich (2 slices bread, 1 oz American cheese, 1 tsp margarine)*

*Jell-o 1 cup*

*240 cc CIB prepared with 2% milk*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Food**  | **Serving Size** | **CHO (grams)** | **PRO (grams)** | **Fat (grams)** | **Calories**  |
| Cheerios | 1 cup | 22 | 3 | 2 | 110 |
| Whole milk | 1 cup | 12 | 8 | 8 | 149 |
| CIB with 2% milk | 240 cc= 1 cup | 32 | 14 | 5 | 223 |
| Bread | 2 slices | 26 | 4 | 2 | 138 |
| American Cheese | 1 oz. | 2 | 5 | 7 | 95 |
| Margarine | 1 tsp | 0 | 0 | 4 | 34 |
| Jell-O cup | 1 cup | 34 | 3 | 0 | 149 |
| CIB with 2% milk | 240 cc= 1 cup | 32 | 14 | 5 | 223 |
| **Total** |  | **160 grams**  | **51 grams** | **33 grams** | **1,121 kcal** |

 *a. Calculate her intake and average for these two days of calorie counts.*

CHO: (123 g + 160 g) / 2= 141.5 grams

PRO: (27 g + 51 g) / 2= 39 grams

Fat: (17 g + 33 g) / 2= 25 grams

Calories: (735 kcal + 1121 kcal) / 2= 928 calories

 *b. What recommendations would you make regarding her enteral feeding?*

The recommendations I would make regarding her enteral feeding is that over time they should be gradually decreased. Based on Chelsea’s average intake over the past two days she has was able to consume an increased amount of calories through PO feedings. I would continue with a mechanical soft diet until she is able to meet all her recommended amounts of energy needs. In general, she should try to consume more high protein items when decreasing the amount of enteral feedings, she is receiving.

Resources

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