



Presented By: Christy Gardner, Dietetic Intern

Case Study: Traumatic Brain Injury

Objectives

- Understand how traumatic brain injury affects nutrition
- Pathophysiology of traumatic brain injury
- Nutritional interventions
- Case study
- Outcomes



The Central Nervous System and Nutrition

The central nervous system (CNS) is the controller of nutrient uptake

Internal signaling mechanism maintaining homeostasis of:
blood glucose
Electrolytes
Triggering the consciousness of hunger and thirst



Acute brain injury through trauma results in immediate effects on nutritional needs.

Increased energy
Increased protein
Increased inflammation

TBI Pathophysiology

- Penetration of the brain's structure can tear apart neurons and shear axons to disrupt neuronal circuitry and damage the vasculature, allowing movement of blood and leukocytes into the brain.¹
 - This results in an immediate impact on the brain by producing necrotic cell loss as well as apoptosis of the surrounding cells.¹
- A local inflammatory response occurs where astrocytes and microglia secrete proinflammatory cytokines, such as tumor necrosis factor (TNF), interleukin-6 (IL-6), and interleukin-1 β .²⁻⁴
- Proinflammatory cytokines mobilize immune and glial cells to the injury site, causing edema and further inflammation.⁴
- This phase is associated with gliosis, demyelination, and continued apoptosis.⁵
- Hypoperfusion may occur acutely after injury, likely caused by reduced blood pressure, impaired vasodilation, and elevated intracranial pressure.⁶⁻⁷ This may later result in hyperemia, after which hypoperfusion may return and be accompanied by vasospasms.

1. Raghupathi R. Cell Death Mechanisms Following Traumatic Brain Injury. *Brain Pathology*. 2004; 14 (2): 215-22.

2. Ekmark-Lewen S, Lewen A, Israelsson C, et al. Vimentin and GFAP responses in astrocytes after contusion trauma to the murine brain. *Restor Neurol Neuroscience*. 2010; 28 (3):311-21.

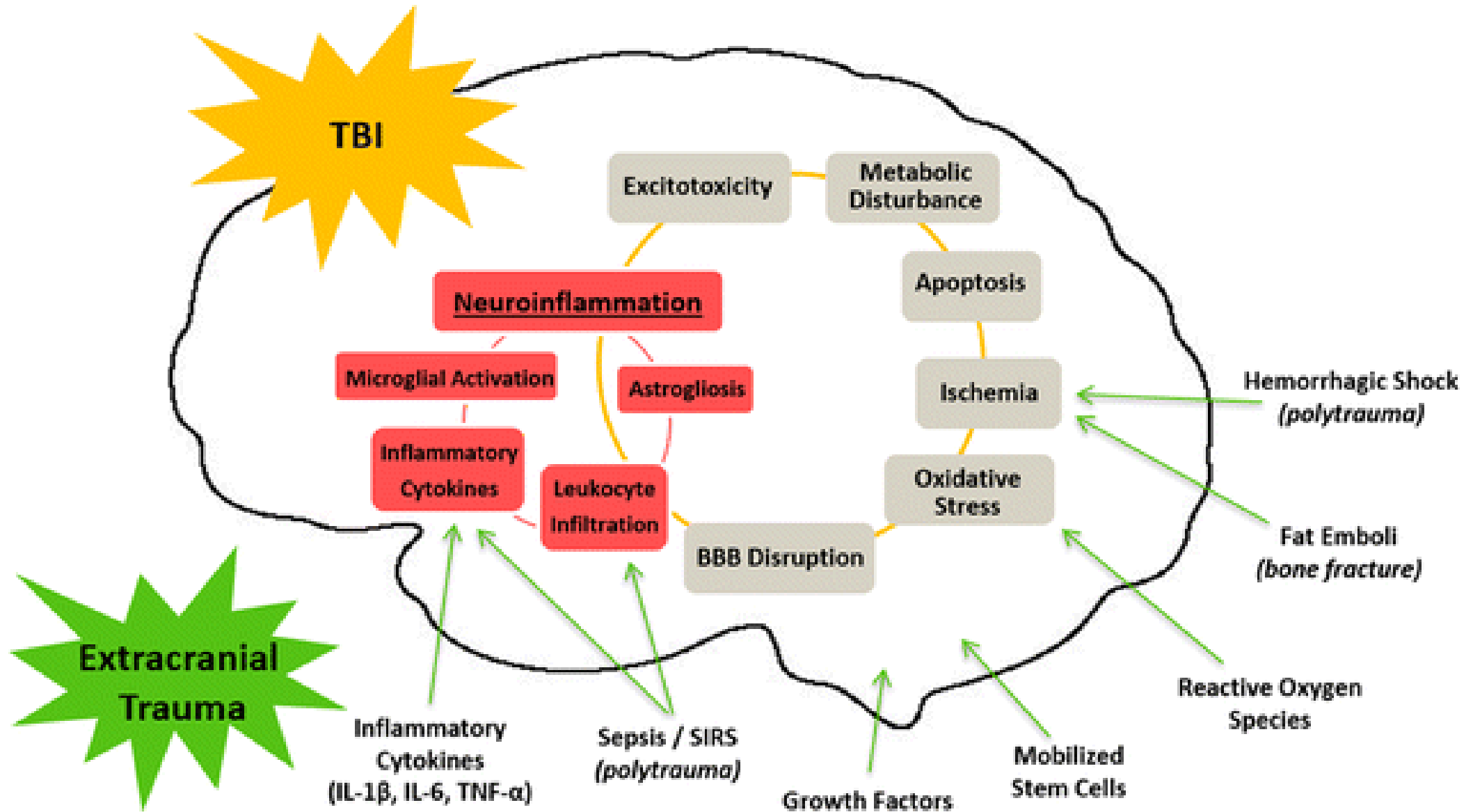
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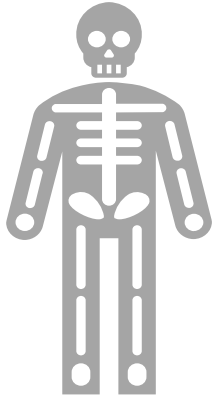
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6. Scalfani MT, Dhar R, Zazulia AR, et al. Effect of osmotic agents on regional cerebral blood flow in traumatic brain injury. *Journal of Critical Care*. 2012;27(5):526.7-12.

7. Stein DM, Hu PF, Brenner M, et al. Brief episode of intracranial hypertension and cerebral hypoperfusion are associated with poor functional outcome after severe traumatic brain injury. *Journal of Trauma*. 2011;71(2):364-73.



Managing Traumatic Brain Injury (TBI) in the Intensive Care Unit (ICU)



Invasive

Hemicraniectomy

Laparotomy

Craniotomy



Noninvasive Interventions

Hyperosmolar therapies

Anesthetics to reduce cerebral metabolic rate

Early nutrition

Nutritional Interventions in TBI



Implemented within
48 hours post injury



Hyper metabolism
catabolism and
nitrogen losses



Brain Trauma
Foundation guidelines
estimate calorie
needs between 120%
to 160% of estimated
basal needs and 1.5 to
2 gm Protein/kg/day.

HBE x 1.2-1.6



Careful attention
must be made to
monitor for signs of
overfeeding:
Elevated respiratory
quotient
Hyperglycemia

Enteral Nutrition Support

1. Chiang YH, Chao DP, Chu SF, Lin HW, Huang SY, Yeh YS, Lui TN, Binns CW, Chiu WT. Early Enteral Nutrition and Clinical Outcomes of Severe Traumatic Brain Injury Patients in Acute Stage: A Multi-Center Cohort Study. *Journal of Neurotrauma*. 2012; 75- 80.
2. Härtl R, Gerber L, Ni Q, Ghajar J. Effect of Early Nutrition on Deaths Due to Severe Traumatic Brain Injury. *Journal of Neurosurgery*. 2008; (109); 50-56.
3. Haltmeir T, Inaba K, Schnüriger B, Siboni S, Benjamin E, Lam L, Clark D, Demetriades D. Factors Affecting the Caloric and Protein Intake Over Time in Critically Ill Trauma Patients. *Journal of Surgical Research*. 2018; (226); 64-71.
4. Rai VRH, Phang LF, Sia SF, et al. Effects of Immunonutrition on Biomarkers in Traumatic Brain Injury Patients in Malaysia: a prospective randomized controlled trial. *BMC Anesthesiol*. 2017;17(1):81. Published 2017 Jun 15. doi:10.1186/s12871-017-0369-4

Initiation within 48 hours post-injury is associated with:

- Increased survival¹⁻³
- Improved GCS recovery¹⁻³
- Overall outcomes¹⁻³

Immunomodulating formulas⁴

- Ω -3⁴
- MCT⁴
- L-arginine⁴
- Glutamine⁴
- Antioxidants⁴

Case Study

- 32 year old Hispanic male was involved in a motorcycle accident on South Beach.
- Patient presents with major trauma and slingshot vehicle, hit, flown 20-30 ft, loss of cognition.
- The patient was un-helmeted, and brought to Ryder Trauma Center where a CT scan of the brain demonstrated diffuse subarachnoid hemorrhage of traumatic nature.
- The patient initially arrived with a Glasgow Coma Score of 9, combative and saturating 98% on restlessness and agitation.
- CT brain 4 hours following initial imaging revealed worsening epidural hemorrhage and patient was taken to OR for emergent craniotomy.
- Post OP patient Glasgow Coma Score decreased to 3T patient currently on ventilator. The medical team placed a nutrition consult to establish enteral nutrition goal rate.

Nutrition Assessment Day 1

Pt seen in the room sleeping with family at bedside.

OGT placed for nutrition support.

Pt currently intubated.

NPO

No reported BM.

Large abrasion present on the left knee.



Anthropometric Measurements

Height: 185.0 cm

Current Weight: 87.0 kg

BMI: 25.4

IBW: 80.9 kg

%IBW: 107.5%

Adj. BW: NA

Usual Body Weight: NA

Weight Changes: NA

Current Oral Intake Status: NPO

Biochemical Data:

Pertinent Labs: Gluc (H): 173, Na (L): 136, K (L): 3.4

Pertinent Meds/Supplements : HumaLOG, Rocuronium

Skin Issues: Abrasion (deep muscle wound per EMR), no pressure injuries

Nutrition Acuity Level: High

Intake/Output: 1468/1310

Balance: +158 mL

Oral Intake: 0 mL

Urine Output: 1210 mL

Stool: 0

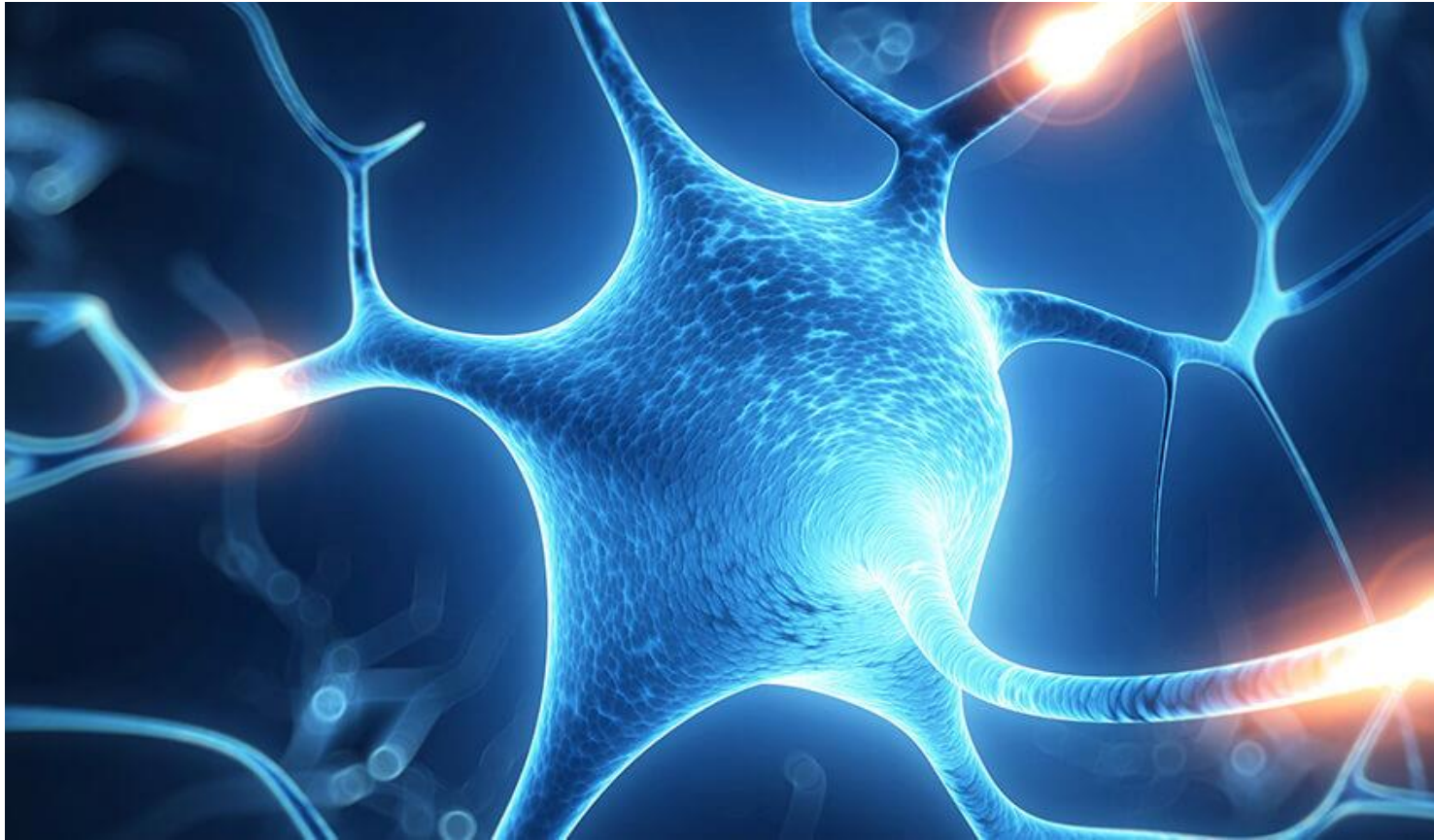
Emesis: 0

Nutrition
Focused
Physical
Findings



N/A pt unconscious, ventilated,
and in critical condition with
family present





Estimated Nutrition Needs

Calories (Kcal): 30-35 kcal/kg
CBW= 2610-3045 kcal/day;
Penn State: 2154 kcal/day

Protein (gm): 1.4-1.7 gm
pro/kg CBW= 121-148 g
protein/day

Fluid (mL): Per MD

NCP:
NUTRITION
DIAGNOSIS:

1. Increased nutrient needs related to metabolic demands for healing as evidence by traumatic brain injury.
2. Chewing/swallowing difficulty related to mechanical issues as evidence by ventilator dependence.

NCP: RECOMMENDATION(S)/INTERVENTION(S):

Nutrition prescription/recommendation:

- Pivot 1.5 Cal at 60 mL/hr (2160 kcal/d, 135 g Pro/d, 1093 ml free fl)
- Initiate at 20 mL/hr and advance by 20 mL/hr every 8-12 hours as tolerated until goal rate reached

Intervention/Goal:

- Meet 80-100% of estimate kcal/protein needs

NCP: Monitoring:

01

Monitor tolerance to enteral feeds

02

Monitor nutrition related labs

03

Monitor skin integrity

04

Monitor weight

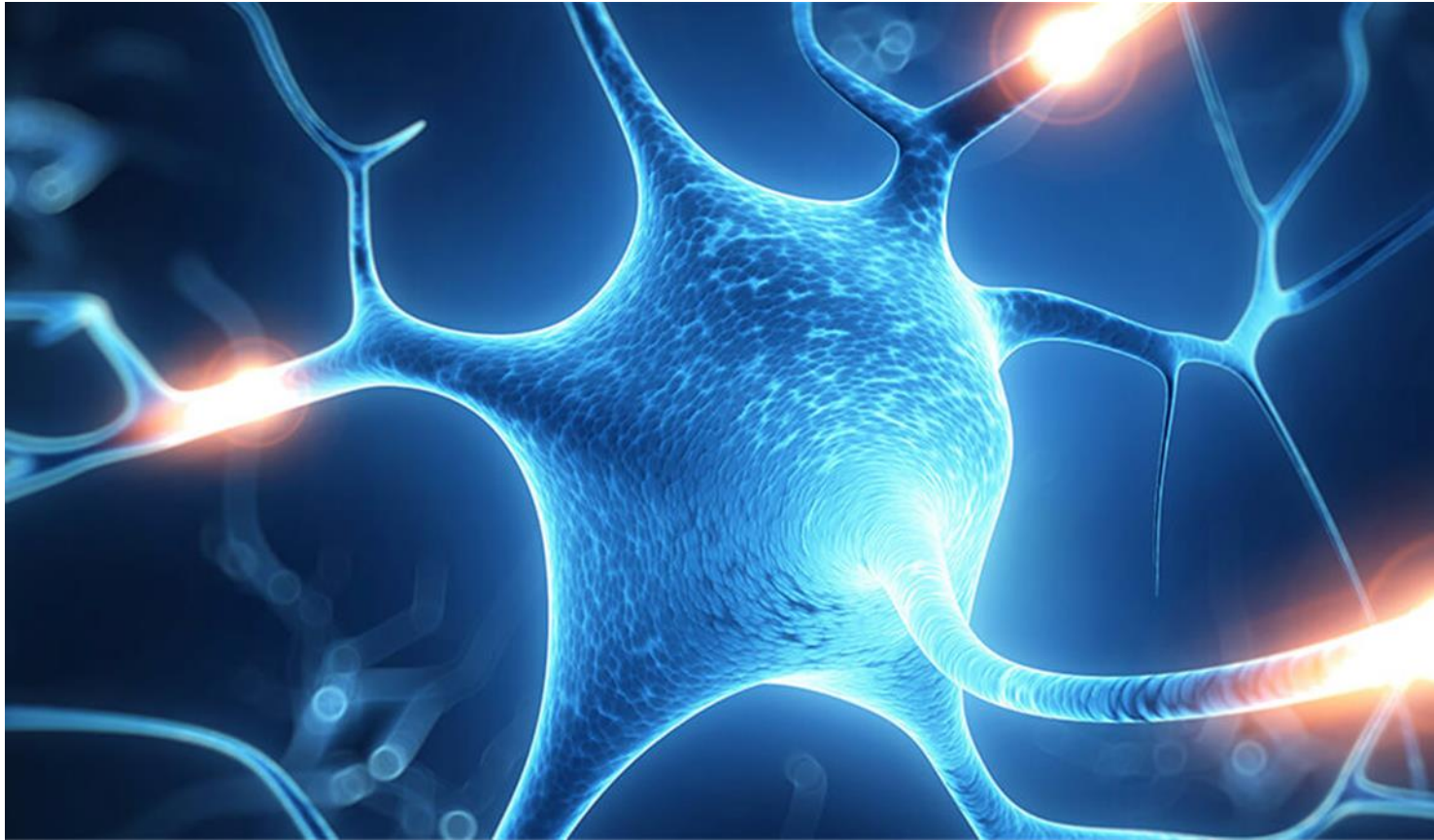
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Monitor I/O's

Nutrition Reassessment

- Pt now extubated
- Stable condition (GCS 14)
- SLP recommends “puree diet upgrade as tolerated”
- Pt seen with family at bedside. Per family report pt does not want solid foods due to pain in esophagus and neck brace.
- Pt requesting shakes from family and spoke with family on supplementing with “Ensure”





Estimated Nutrient Needs

- **Calories (Kcal):** 30-35 kcal/kg
CBW= 2610-3045 kcal/day
- **Protein (gm):** 1.2-1.7 gm
protein/kg CBW= 104-148 g
protein/day
- **Fluid (mL):** 1 mL/kcal or as
per MD

NCP: RECOMMENDATION(S)/INTERVENTION(S):

Nutrition prescription/recommendation:

- When feasible recommend regular diet, mechanical soft consistency
- When feasible supplement with Ensure (350 kcal; 20 g Pro)

Additional Recommendation/Intervention/:

- Meet 80-100% of estimate kcal/protein needs

Outcomes

Pt moved to a less acute floor
Discharged two days following
Pt upgraded to a regular diet



Conclusion

- When managing the nutrition support for a patient post TBI, an aggressive approach should be taken nutritionally
- Ensure the patient's energy and protein needs are being met
 - hyper metabolic and catabolic physiologic state with elevated needs
- Inflammatory-modulating nutrition support can be efficacious in neurological trauma to decrease inflammation

Questions

