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JBI BEST PRACTICE EVIDENCE SUMMARY

Burns (Hypermetabolic Response): Nutrition Management (Pediatric and Adult)

Question

What is the best available evidence regarding the nutritional management of hypermetabolic response to children, adolescents and adults with burn injury in the acute and rehabilitation phases?

Clinical Bottom Line

Major burn injuries (greater than 20% of total body surface area [TBSA]) result in a hypermetabolic response.[1] A hypermetabolic response is an abnormal metabolism of nutrients and increased nutritional requirements due to increased production of catecholamines, glucocorticoids and glucagon.[1] This leads to malnutrition, severe body weight loss and increased morbidity and mortality.[2] The severity and duration of the hypermetabolic response is proportional to the severity (depth and extent) of the burn injury.[1] Nutrition therapy is an integral component of management.[1]

- A clinical guideline endorsed by ESPEN (European Society for Clinical Nutrition and Metabolism) and based on ESPEN recommendations states the following regarding nutritional therapy in adults and children with burns:[1] (Level 5)
  - Early enteral nutrition (oral diet and/or enteral tube) is strongly advised, commencing within 12 hours of injury. Early enteral feeding is associated with attenuation of stress hormone levels and the hypermetabolic response, increased immunoglobulin production, reduced stress related gastric ulcers, and reduced risk of malnutrition and energy deficit. Parenteral nutrition should only be used if enteral feeding is contraindicated or fails.
  - If enteral feeding via a gastric tube is required, the choice of feeding solution should be polymeric, high energy and high nitrogen as well as containing fiber due to the high risk of constipation from reduced mobility, opioids and fluid shifts.
  - Protein requirements of 1.5 to 2gm per kg for adults and 3gm per kg for children (age not specified) is recommended as well as supplementation with glutamine (dose not specified). There was no evidence to support supplementation with arginine.
  - Glucose delivery should be limited to a maximum of 55% of energy requirements or limited to 5mg/kg/hour and target blood glucose level of 4.5-8mmol/L controlled with continuous infusion.
  - Fat administration should be limited to approximately 30% of total energy delivery.
  - Nutritional supplementation with zinc, copper, selenium and vitamins B1, C, D and E is strongly recommended.
  - Indirect calorimetry, if available, should be used to assess energy requirements. In the absence of indirect calorimetry, the use of the Toronto equation in adults and the Schofield equation in children may be used.
  - Clinicians should consider that the acute and prolonged hypermetabolic response is directly proportional to the severity of the injury (TBSA) and is variable over time due to healing. Overfeeding causes morbidity such as fatty liver infiltration and increased incidence of infections.
  - Both nutritional and non-nutritional strategies are required to attenuate the hypermetabolic response. In the acute phase, non-nutritional strategies may include pharmacological adjuncts (e.g. insulin, propranolol, oxandrolone) and physical interventions (e.g. early surgery and thermo-neutral room).
- A randomized controlled trial (RCT) observed the pharmacological effects of enteral (via a gastric or enteral tube) glutamine supplementation (0.5 g/kg per day) in adults with severe burn injuries

(TBSA 30-75% and full thickness area 20-58%). All participants received standard nutrition solution, the intervention group had glutamine granules (0.5m/kg) mixed in their nutrition solution. Average calorie intake and nitrogen intake was the same in both groups. The study was conducted over a 14-day period. Plasma glutamine, plasma protein, urine nitrogen and urine 3-methylhistidine excretion were measured, as well as length of hospital stay. Plasma glutamine was higher in the intervention group and plasma protein was the same. The urine nitrogen and 3-MTH excretion were higher in the intervention group indicating that glutamine supplementation was associated with decreased protein catabolism. The length of stay was less in the intervention group by 2 days (average 23 days versus 25 days). The authors concluded that enteral supplementation with glutamine granules cold abate the degree of glutamine depletion, promote protein synthesis, inhibit protein decomposition and reduce length of hospital stay.[2] (Level 1)

- A small observational study compared the effect of goal rate re-initiation of enteral nutrition to slow re-initiation in burn patients (average TBSA 38%) following interruptions in the administration of enteral nutrition, such as when surgical procedures are performed. Participants received all nutritional supplementation via a gastric tube (not post-pyloric). Slow re-initiation commences at 20mls/hr and increases by 20mls/hour every 4 hours until the goal rate is achieved. Total caloric provision, gastrointestinal complications and gastric residual volume were compared. The results showed that enteral nutrition could be re-initiated at the goal rate, after the first excision and grafting in those patients who had previously tolerated goal rate gastric enteral nutrition and who were hemodynamically stable. Results should be interpreted with caution due to the very small number of participants.[3] (Level 3)
- A systematic review assessed the effectiveness of early (within 24 hours) versus late (after 24 hours) enteral nutrition support in adults with burn injury. Based on a small number of moderate to high-quality studies, the results of the review showed that early enteral nutrition support, defined as within 24 hours, might attenuate the hypermetabolic response for adults with burns.[4] (Level 1)

Characteristics of the Evidence

[4]This evidence summary is based on a structured search of the literature and selected evidence-based health care databases. The evidence in this summary comes from:

- A clinical practice guideline.[1]
- A randomized double-blind study involving 48 participants aged 18-60 years.[2]
- An observational study of 14 adults (>18 years).[3]
- A systematic review of 3 RCTs that included 70 participants (aged >18 years).[4]

Best Practice Recommendations

1. Commencing early enteral nutrition support, within 24 hours of the burn injury, is recommended. If enteral nutrition is contraindicated or not tolerated parenteral nutrition should be administered. (Grade A)
2. Enteral feeding solution, via a gastric or post-pyloric tube, should contain fiber and be polymeric, high energy and high nitrogen. (Grade B)
3. Glutamine supplementation may be considered. Clinician judgement is recommended. (Grade B)
4. Protein requirements of 1.5 to 2gm/kg for adults and 3gm/kg for children are recommended. (Grade B)
5. Fat requirements should be limited to approximately 30% of total energy delivery. (Grade B)
6. Glucose delivery should be limited to a maximum of 55% of total energy requirements or limited to 5mg/kg/hour. (Grade B)
7. Blood glucose levels should be maintained at 4.5 to 8mmol/L. (Grade B)

8. Nutritional supplementation that includes zinc, copper, selenium and vitamins B1, C, D and E is recommended. (Grade B)
9. Indirect calorimetry is recommended to ascertain individual energy requirements. (Grade B)
10. In the absence of indirect calorimetry, the Toronto equation may be used in adults and the Schofield equation in children. (Grade B)

References

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4. Wasiak J, Cleland H, Jeffery R. Early versus delayed enteral nutrition support for burn injuries. Cochrane Database Syst Rev. 2006;(3):Cd005489.

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