**Optimizing Nutrition Initiation and Maintenance Within Pediatric Critical Care**

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**Introduction**

The role of nutrition has become increasingly correlated to the clinical outcomes of pediatric patients, especially in the critical care setting. Research states that prolonged inadequate energy/protein intake is associated with adverse clinical outcomes, including:  
- longer periods of ventilation  
- higher risk of hospital-acquired infection  
- longer ICU and hospital stay  
- increased mortality

It is crucial to meet energy/protein needs for pediatric patients in order to avoid nutrition deterioration, which can negatively affect clinical outcomes.

In order to ensure that pediatric patients meet their nutritional needs in order to optimize healing, the American Society of Parenteral and Enteral Nutrition (ASPEN) created a set of guidelines for practitioners to follow:

- initiation of nutrition within 24-48 hours in order to improve clinical outcomes
- obtaining a metabolic cart (MC) and 24-hour urine urea nitrogen (UUN) within 24-48 hours
- obtaining a new MC and/or 24hr UUN weekly after the first set of tests in order to better estimate energy/protein needs since nutritional needs may change for various reasons, such as change in work of breathing and severity of illness/trauma

A metabolic cart essentially measures the oxygen consumed and the carbon dioxide produced by the patient and then calculates the energy expenditure for the patient using the Weir equation: Energy Expenditure = (3.94 x VO2) + (1.1 x (VCO2). A 24-hour urine urea nitrogen measures the amount of urea nitrogen in your urine to better estimate protein needs.

While the ASPEN guidelines provide parameters to meet patients’ nutritional needs, research shows that critically ill patients frequently never achieve target nutrition due to delayed nutrition initiation, intolerance and inaccurate estimated energy/protein needs.

Monitoring nutrition initiation, nutrition support tolerance/adeguacy and ordering MC/24hr UUNs were not a part of routine practice. Therefore, focusing on appropriate nutrition initiation and nutrition adequacy was agreed upon by the small group of intensivists, nurse practitioners, and unit dietitians.

**Materials**

- Ultima CCM™ indirect calorimeter
- Foley Catheter
- Amber urinal with leak proof screw cap lid
- Excel spreadsheet

**Methodology**

The first cycle was examining if nutrition support was started within 24-48 hours, while comparing total volume goals against the total volume received on the feeding tube pump.

The second cycle sought to implement ASPEN guidelines using MC and 24-hour UUN to adequately determine calorie and protein needs. For instances where a MC and/or 24hr UUN were not feasible, unit dietitian estimated energy needs using Schefield and calculated protein needs by using 1.5 g/kg per ASPEN recommendations.

Data collection was driven by the unit dietitian. Orders for feeds and studies were driven by the nurse practitioners. Data was collected for 18 months.

**Results**

Initiating nutrition support within 24-48 hours was achieved with ~90% of patients. Patients who did not receive nutrition support within 24-48 hours were:
- medically unstable (MAPs <60)
- required immediate intervention in the OR
- underwent repeated extubation trials

Within 24 hours, 88% of patients had received total volume goal. Within 48 hours, 89% of patients had received total volume goal. Within 96 hours, 88% of patients had received total volume goal.

Common reasons for not being able to reach total volume goal were:
- enteral nutrition (EN) held for OR/testing
- extubation trials
- patient status declined
- patient advanced to PO diet
- feeding intolerance (abdomen distension, nausea/vomiting, diarrhea)

MC were only obtained in 11 of 41 patients but refined calorie goals in all. The challenges of obtaining MC were that the tidal volumes were too low to reliably measure as the FIOT was too high.

24hrUUNs were obtained in 18 out of 41. The primary difficulty of obtaining 24hrUUNs was lack of Foley catheter. Most of the patient population required Foley catheters or diapers; therefore, 24hr UUNs were unable to be collected using urines due the patients’ medical status. In 10 of the 18, including all the trauma patients, protein had to be increased from the recommended 1.5 g/kg/day to 17.3 g/kg/day. In 6 of 18 who then had multiple studies, all required more protein than the initial study.

**Conclusion**

The goal was to improve the timeliness and effectiveness of reaching target nutrition needs following the American Society for Parenteral and Enteral Nutrition (ASPEN) guidelines. With intentional effort, initiating nutrition and getting to estimated goal nutrition is readily achievable. Obtaining the additional studies are significantly more challenging but helpful in refining calorie goals and protein goals, which are markedly greater than ASPEN guidelines.

**Discussion**

Nutrition initiation and adequacy are vital in order to ensure that pediatric patients in critical care meet their nutritional needs. MC and 24hr UUN are the gold standard to ensure that nutritional needs are calculated appropriately. However, it appears that obtaining the necessary tests in order to determine a patients’ nutrition may be challenging. MC are not feasible for all patient populations, such as infant or someone recently on anesthesia. More research is needed to examine what equations or tests can be used in situations when the MC is not feasible. Sim Darby, Foley catheters are not risk free. The main problem with urinary catheters are infections in the urethra, bladder or kidneys. Foley catheters can also sometimes lead to other problems, such as bladder spasms, leakages, blockages and damage to the urethra. More research is needed to determine if the benefits of performing 24hr UUNs outweigh the risks of foley catheters.

**References**


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Purpose: The goal was to improve the timeliness and effectiveness of reaching target nutrition needs following the American Society for Parenteral and Enteral Nutrition (ASPEN) guidelines.

Relevance/Significance: The role of nutrition has become increasingly correlated to the clinical outcomes of pediatric patients, especially in the critical care setting. Research states that prolonged inadequate energy/protein intake is associated with adverse clinical outcomes, including longer periods of ventilation, higher risk of hospital-acquired infection, longer ICU and hospital stay, and increased mortality. Therefore, it is crucial to meet energy/protein needs for pediatric patients in order to avoid nutrition deterioration, which can negatively affect clinical outcomes. Critically ill patients frequently never achieve target nutrition due to delayed nutrition initiation, intolerance and inaccurate estimated energy/protein needs. ASPEN recommends the initiation of nutrition within 24-48 hours in order to improve clinical outcomes. Nutrition support must be individualized due to the unique complexity of pediatric patients. Therefore, ASPEN recommends obtaining a metabolic cart (MC) and 24-hour urine urea nitrogen (UUN) within 24-48 hours and then weekly thereafter in order to better estimated energy/protein needs. Monitoring nutrition initiation, nutrition support tolerance/adequacy and ordering MC/24hr UUNs were not a part of routine practice.

Strategy and Implementation: Focusing on nutrition was agreed upon by the small group of intensivists, nurse practitioners, and unit dietitian. The first cycle was benchmarking against estimated nutrition goals. The second cycle sought to implement ASPEN guidelines using MC and UUN to refine nutrition goals. Data collection was driven by the unit dietitian. Orders for feeds and studies were driven by the nurse practitioners. Data was collected for 18 months.

Evaluation/Outcomes: Initiating nutrition support within 24-48 hours was achieved with >90% of patients. Patients who did not receive nutrition support within 24-48 hours were medically unstable (MAPs <60); required immediate intervention in the OR; and underwent repeated extubation trials. Within 24 hours, 88% of patients had received total volume goal. Within 48 hours, 89% of patients had received total volume goal. Within 96 hours, 88% of patients had received total volume goal. Common reasons for not being able to reach total volume goal were EN held for OR/testing, extubation trials, patient status declined, patient advanced to PO diet and EN intolerance (abdomen distension, nausea/vomiting, diarrhea). MC were only obtained in 11 of 41 patients but refined calorie goals in all. Challenges of obtaining MC were patient’s age/weight and respiratory status. 24hrUUNs were obtained in 18 out of 41. The primary difficulty of obtaining 24hrUUNs was lack of foley catheter. In 10 of the 18, including all the trauma patients, protein had to be increased from the recommended 1.5 g/kg/d to 1.7-3 g/kg/day. In 6 of 18 who then had multiple studies, all required more protein than the initial study.

Implications: With intentional effort, initiating nutrition and getting to estimated goal nutrition is readily achievable. Obtaining the additional studies are significantly more challenging but helpful in refining calorie goals and especially protein goals, which are markedly greater than ASPEN guidelines.