Nutrition Support for Sepsis-Induced Acute Kidney Injury in a Critical Care Setting: A Case Report

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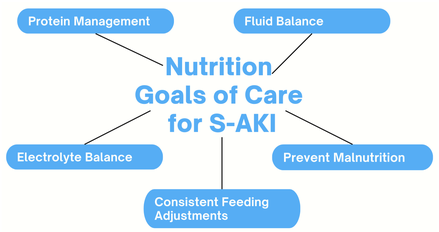
Background

Sepsis-induced acute kidney injury (S-AKI) is a severe complication in critically ill patients, associated with increased mortality, prolonged hospital stays, and complex medical management.[1] AKI is characterized by a sudden decline in kidney function, leading to fluid imbalance, electrolyte disturbances, and metabolic waste accumulation.[1] Symptoms include fluid retention, decreased urine output, fatigue, confusion, and shortness of breath.[2] With a prevalence of 40-50% of patients in the ICU developing AKI, nutrition therapy plays a crucial role in managing these patients, with evidence-based guidelines recommending individualized energy, protein, and fluid interventions. This case report reviews the importance of proactive individualized nutrition interventions to aid in patient recovery including improved nutritional status and AKI resolution.



Nutritional Considerations

Nutritional support in patients with S-AKI is highlighted through specific medical nutrition therapy guidelines that focus on optimizing energy and protein intake, fluid management, and electrolyte balance. Common factors to consider in S-AKI nutrition care is critical care status, intubation, malnutrition, and ability to consume.

Medical Nutrition Therapy:

- Enteral nutrition (EN) is preferred and should be initiated if oral intake is not feasible within the first 24-48 hours[4,5,6]
- Early and progressive parenteral nutrition (PN) can be provided instead of no nutrition in case of contraindications for EN in severely malnourished patients[5]

Kcals:

- Energy requirements in patients with renal disease should be evaluated using indirect calorimetry when possible. If indirect calorimetry is not possible, individualized assessment of energy intake goals utilizing predictive methods is recommended.[5]
- 20-30 kcal/kg/d in patients with any stage of AKI should be achieved[5,6]

Protein:

- Highly varied in S-AKI based on critical care status, goals for renal preservation, and if patient is on renal replacement therapy. See table 1 for protein guidelines.

Fluids:

- Continuous evaluation and multidisciplinary collaboration is utilized to determine fluid needs

Monitoring of Labs:

- Electrolyte abnormalities (sodium, potassium, phosphorus),[5] daily tolerance of EN,[4] ongoing protein adjustments,[4] water soluble vitamins on RRT (vitamin C, folate, and thiamine)[5]

Table 1: Energy & Protein Guidelines

Critical Care	1.2–2.0 g/kg actual body weight per day[4]
Decline in Renal Function	0.8-1.0 g/kg/d of protein in non-catabolic AKI patients without need for dialysis[5,6]
Renal Replacement Therapy (RRT)	Hemodialysis: intermittent RRT • 1.3–1.5 g/kg/d[5] Continuous Renal Replacement Therapy (CRRT): • Patients receive increased protein, up to a maximum of 2.5 g/kg/d[4]

Case Report

Case Summary:

- Patient: 81-year-old male with a past medical history of coronary artery disease, type II diabetes, congestive heart failure, high cholesterol, complete heart block s/p pacemaker placement, dementia, dysphagia, nephrolithiasis, hydronephrosis, recent weight loss, malnutrition, and hypertension.
- Clinical Course: Admitted with acute hypoxemic respiratory failure and septic shock; developed AKI secondary to sepsis requiring dialysis.
- Nutrition Challenges: Severe malnutrition, lack of mental status, prolonged lack of oral intake due to family refusal of feeding tube, requiring PN and EN initiation.

Assessment:

- Anthropometrics: Height: 6'2" Admission Weight-141 lbs (64 kg) Ideal Body Weight-170 bs (77kg) BMI- 18.1 (underweight) Admission Weight change: +13 lbs (fluid retention and increased intake)
- Nutrition Focused Physical Exam Findings: Severe muscle wasting (temples, clavicles, deltoids, scapula, trapezius, calf) and subcutaneous fat loss (triceps)
- Pertinent Lab Indicators: Rapid renal decline with increasing creatinine, blood urea nitrogen levels, and a decrease in glomerular filtration rate. Fluctuating electrolyte lab values including both hyper and hypo- natremia, kalemia, and phosphatemia.

Nutrition Diagnosis:

- Increased nutrient needs (protein) related to increased demands as evidence by pt starting hemodialysis.
- Severe malnutrition in the context of chronic illness related to inadequate energy and protein oral intake due to swallowing issues and lack of nutrition support as evidence by admit BMI 18.1, reported 9 lb. (7%) wt loss in 6 months, severe muscle wasting (temples, clavicles, deltoids, scapula, trapezius, calf), and severe subcutaneous fat loss (triceps), <90% of estimated energy and protein needs met.

Interventions:

- Parenteral Nutrition (PN): Initiated due to patient being unable to consume oral diet and patient family refused enteral nutrition; provided 51g protein and 408 kcal/day.
- Enteral Nutrition (EN): Renal specific formula (high protein, calorie-dense with less fluid volume, lower in potassium, phosphorus, and sodium) introduced at 10 ml/hr via nasogastric tube, increased to goal rate providing 1728 kcal and 78g protein.
- Protein Supplementation: An additional 20g of protein supplemented via EN route due to higher protein needs while on hemodialysis.
- Estimated Energy Needs: Reassessed frequently to individualized needs based on critical care status. See Table 2.
- Fluid & Electrolyte Management: Adjusted per RRT status, monitored for edema and electrolyte imbalances.

Outcomes:

- On day 9 the patient achieved the feeding goal rate and met estimated energy and protein needs consistently
- Water flushes were decreased due to fluid retention and edema in collaboration with the nephrologist
- On day 23 AKI resolved, and the patient had full renal recovery
- Patient discharged to a long-term acute care on renal specific EN formula

Table 2: Estimated Energy & Protein Needs Throughout Hospital Admission

Initial Assessment	Based on CBW 57 kg Kcals: 1710-1995 kcals/day (30-35 kcal/kg), Protein: 68-80 g/day (1.2-1.4 g/kg) Fluid: 1500 ml fluid/day
Decreased Kidney Function	Based on CBW 57 kg Kcals: 1596-1710 kcals/day (28-30 kcal/kg), Protein: 57-68 g/day (1.0-1.2 g/kg) Fluid: 1500 ml fluid/day
Started on RRT; Hemodialysis	Based on low end IBW 77 kg Kcals: 1617-1848 kcals/day (21-24 kcal/kg), Protein: 92-116 g/day (1.2-1.5 g/kg) Fluid: 1700 ml fluid/day
Increased Edema	Based on low end IBW 77 kg Kcals: 1617-1848 kcals/day (21-24 kcal/kg), Protein: 92-116 g/day (1.2-1.5 g/kg) Fluid: 1200 ml fluid/day
AKI Resolved	Based on low end IBW 77 kg Kcals: 1617-1848 kcals/day (21-24 kcal/kg), Protein: 77-92 g/day (1.0-1.2) Fluid: 1200 ml fluid per provider

Discussion and Implications

Nutritional Implications:

- Delayed Nutrition Initiation: The patient had no oral intake for three days due to family refusal of enteral support.
- Protein and Energy Requirements: Continuous monitoring ensured that protein intake was adjusted appropriately without increasing kidney burden during S-AKI progression and recovery. Protein supplementation (ProSource) was used to meet increased demands during RRT.
- Fluid and Electrolyte Balance: Fluid management was challenging due to fluctuating renal function and hemodynamic instability. Ongoing electrolyte monitoring and modifications to enteral feeding water flush and supplementation were necessary to prevent imbalances. Nephrology continued to update the fluid needs, and the flush was adjusted accordingly.
- Malnutrition: Due to the patient's nutrition focused physical exam findings, there was concern for further muscle and fat wasting malnutrition. The plan of care included extra precautions to ensure no further weight or muscle loss occurred during hospital stay.

Future Practice Recommendations:

Early Nutrition Support

- Proactive initiation of enteral nutrition within the suggested timing guidelines is crucial to preventing severe malnutrition and optimizing patient outcomes for S-AKI.

Standardized Fluid and Electrolyte Protocols

- Establishing clear guidelines for hydration and electrolyte monitoring can improve patient safety and prevent complications associated with S-AKI.

Multidisciplinary Collaboration

- Close coordination between dietitians, physicians, and nursing staff is essential in managing nutrition support effectively in critically ill patients.

Effective Family Education

- Addressing concerns and misconceptions about artificial nutrition early in the clinical course can facilitate timely intervention and improve acceptance of necessary feeding modalities.

Conclusion

S-AKI complicates medical nutrition therapy due to altered protein metabolism, increased metabolic demands, fluid imbalances, increased malnutrition risk, and electrolyte imbalances. Medical nutrition therapy goals for S-AKI focuses on individualized energy and protein provision, fluid management, and electrolyte balance to support metabolic demands while preserving kidney function to promote renal recovery. Early enteral nutrition (EN) is prioritized when feasible, with parenteral nutrition (PN) serving as a bridge when EN is contraindicated. Protein needs vary based on renal replacement therapy status, and continuous reassessment is necessary to optimize nutrition interventions. Multidisciplinary collaboration plays a key role in ensuring appropriate adjustments to feeding strategies, electrolyte supplementation, and overall patient care to improve outcomes in critically ill patients with S-AKI. Despite the initial challenges, these targeted nutrition interventions contributed to improved nutritional status, steady weight gain, and the resolution of AKI. This case showcases the importance of early PN when EN is not feasible, the estimated needs adjustment importance, EN formula choice, and nutrition supplementation.

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