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In This Issue

Malnutrition in a Maintenance Hemodialysis Patient is Improved with Intradialytic Parenteral Nutrition (IDPN): A Case Study

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This article has been approved for 2.0 CPE units. The online CPEU quiz and certificate of completion can be accessed in the Members Only section of the RPG web site via the *My CPEU* link. In addition, this CPE offering is available to current RPG members only and the expiration date is April 15, 2012

Introduction

Mortality rates continue to be elevated in maintenance hemodialysis (MHD) patients. According to the United States Renal Data System, patients over the age of 65 years of age on hemodialysis have over a 30% mortality rate. This database collects, analyzes and distributes information about patients who have chronic kidney disease (CKD) (1).

High mortality rates in MHD patients have been linked to protein-energy wasting (PEW). De Musert et al, attempted to show that PEW, inflammation and cardiovascular disease are associated with increased mortality in MHD patients. The researchers followed 815 patients with CKD stage 5 on MHD for seven years. They concluded that the concurrent presence of each increased mortality risk due to an additive interaction between these three factors (2).

Mortality has been linked with actual protein intake in MHD patients. In a study by Shinaberger et al, dietary protein intakes were estimated over a two year period by the measure of nitrogen appearance (nPNA) in patients on MHD. In this study the Davita Inc. database was utilized. The database consisted, at the time, of 53,933 patients who were on HD during the two-year study. The data showed that a decrease in protein intake over time was associated with increased risk of death. In this study, the all-cause mortality hazard ratio was case-mix adjusted and also adjusted for markers indicating presence of the malnutrition-inflammation complex syndrome (MICS). An increase in protein intake indicated a trend towards better survival (3).

In a thorough review and meta-analysis of the relationship between serum protein and mortality in adults on long-term HD, Herselman and colleagues concluded that serum albumin showed a significant inverse relation with all-cause and cardiovascular mortality. The treatment of malnutrition and infection in patients on dialysis was recommended to prevent morbidity and mortality (4).

RPG

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Articles about successful programs, research interventions, evaluations and treatment strategies, educational materials, meeting announcements and information about educational programs are welcome and should be emailed to the editor by the next deadline.

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From the Editor's Desk

Megan Sliwa, RD, LDN
Editor

"Our ability to achieve success depends on the strength of our wings gained through knowledge and experience. The greater our knowledge and experience, the higher we can fly" (Catherine Pulsifer, Author). I came across this quote recently and it reminded me how important it is to embrace continuing education and challenge ourselves to seek out new experiences. Whether you provide patient care, educate students, work in industry or one of the many other roles dietitians in renal care hold today, it is through the most current knowledge and experiences that you will achieve success.

With this in mind, I hope the articles in this issue of the Forum provide you with new and different knowledge and inspire you to search for new experiences. The Feature Article by Mona Soucy, MSB, RD, CSR, LD is a very thorough case study and background on improving a maintenance hemodialysis patient with intradialytic parenteral nutrition (IDPN). Following this is a clinical perspective on IDPN by Jessiana Rose, RD, LDN, CNSD, including an IPDN historical background, when to use IDPN and how albumin is affected with IDPN intervention. After the Feature and Advances in Practice Articles, there are two summaries of sessions at ADA's FNCE 2010 as well as two reprint articles that the editorial staff thought would be worthwhile to share. The first is a reprint from the Dietitians in Health Care Communities *Connections* Newsletter that helps to highlight the clarity of Standardized Language seen in the Third Edition of The International Dietetics and Nutrition Terminology; the second reprint is from the *Nephrology Nursing Journal* and outlines implications of obesity in kidney transplant patients. I also encourage you to review the Calendar of Events for educational opportunities throughout 2011.

I hope you will enjoy this issue of the Forum. The editorial team welcomes your comments and suggestions for future issues as well. And if you've recently attended an interesting seminar or read a compelling article, it is likely that fellow members of the RPG would agree… consider sharing it as an original article submission to the RNF Editorial team.

Please be sure your email address on file is up-to-date with the ADA so you can receive this and other e-announcements. The Spring Forum will be published in electronic format only again this year; the overall feedback for this format has been positive and the cost savings to the RPG budget significant.

As always, I'd like to thank all of the volunteers that helped make this publication possible. With the demands of work and life, time comes at a premium. Thank you to the authors, reviewers, the test writer, the editorial staff and the ADA staff for their contributions, expertise and guidance in this process. ◆

Erratum
from Fall 2010 Forum:

Please accept our apologies, in the print version of the Fall *Renal Nutrition Forum*, Vol. 29, No. 4 on page 9, right column, under the 'Decision Support and Patient Self-Management Materials', the last line of the second paragraph should read, "To improve the provider tool, they suggested more details on dietary intervention, a more functional layout, and an organization that reflects CKD disease progression." Please note that on the RPG web site, the pdf version of the Fall Forum and the pdf of the article have both been corrected.

The Kidney Disease Outcome Quality Initiative (K/DOQI) recommends that dialysis patients consume 30 – 35 kcal/kg/day, as higher energy requirements may be needed for protein sparing (5). K/DOQI also recommends a protein intake of 1.2 g/kg of body weight (BW) per day for stable dialysis patients (5). This is more protein than the 0.8 g/kg of BW that is generally recommended for healthy, non-pregnant, non-lactating adults. One of the reasons for the increased need is the loss of amino acids and peptides during dialysis. It is estimated that 6-8 g of amino acids and 2-3 g of peptides are lost during a dialysis treatment (5). MHD patients may also require more protein due to being in a chronic protein catabolic state. The catabolic state may be secondary from uremia which may increase the concentration of inflammatory cytokines. These cytokines can induce anorexia, increase skeletal muscle breakdown, increase whole-body protein catabolism and accelerate hypermetabolism (6,7). Patients can also have chronic inflammation when they are exposed to dialysis membranes, tubing, and catheters (5). Similarly, the Canadian Society of Nephrology and the European Society for Clinical Nutrition and Metabolism recommend 1.2 g/kg BW of protein and 1.2 – 1.5 g/kg BW of protein, respectively, for HD patients.

Morais et al, studied the correlation of nutritional status and food intake in 44 HD patients. The authors found that 90.9% of patients were considered at nutritional risk or moderately malnourished, with calorie intake falling below the recommendations at 20.7 +/- 6.7 kcals/kg/day. The authors also determined that protein ingestion, at 1.2 g/kg/day, was sufficient to meet protein needs (8).

Few strategies have been successful in improving albumin levels in MHD patients. This may be due to the fact that it is unclear whether a low albumin is the result of malnutrition or just inflammation as many HD patients have an elevated level of c-reactive protein, an indication of inflammation (9). Barriers to adequate nutrition in MHD patients have been identified by previous authors and include but are not limited to poor appetite, restricted fluid intake, inadequate dose of dialysis, inadequate nutrition knowledge, poor food choice behavior, poor food preparation skills, and socioeconomic concerns (10). Other factors include depression, dysphagia, and gastrointestinal symptoms (11).

Therapies to improve the nutritional status of MHD patients have consisted mainly of either renal-specific oral supplementation or intradialytic parenteral nutrition (IDPN). IDPN is the provision of dextrose, amino acids and optional lipids through the venous return line in HD patients.

Fouque and colleagues examined the use of a renal-specific oral supplement in HD patients as it relates to nutritional status and quality of life. The study included 88 patients who were randomly assigned to either the standard treatment group or the supplement group. Both groups were provided with dietary advice by the facility dietitian. The supplement group was instructed to consume 250 ml/day of a renal nutrition supplement for three months. No nutritional supplementation was provided for the standard group. The supplement provided an additional 500 kcals and 18.75 g of protein per day. Measurements of nPNA increased significantly in the supplement group and this was correlated with an increase in albumin levels. Dry BW increased slightly after three months in the supplement group in comparison with the standard group. Patients who complied with the therapy also had improved quality of life scores. The authors clearly state that compliance was key for oral supplementation to be effective and noted that the compliance rate was only 66 % (12).

In 2007, Cano and colleagues published a study in which 186 malnourished HD patients received nutritional supplements with or without one year of IDPN. They found that IDPN, in addition to oral nutritional supplementation, did not significantly improve two-year mortality, compared to controls. However, both groups showed significant improvements in BMI, albumin and prealbumin, due to the fact that oral supplements were provided. The authors also reported that a prealbumin > 30 mg/dL independently predicted a 54% decrease in two-year mortality (13).

Hiroshige and colleagues, proposed utilizing IDPN to treat malnutrition in elderly dialysis patients. Twenty-eight elderly, non-diabetic, MHD patients were selected. Of those twenty-eight, ten patients were treated with IDPN for approximately one year. In patients receiving IDPN, there were significant increases in albumin, transferrin concentrations and total lymphocyte count beginning after three months of treatment and remaining positive during the length of the treatment period. Anthropometric data such as dry BW, BMI, % standard triceps skinfold thickness, mid-arm muscle circumference, and mid-arm circumference also improved after six months of treatment. Controls had gradual decreases in all parameters, including anthropometric measures, albumin, transferrin and lymphocyte count, during the study period. The authors concluded that IDPN was effective in preventing muscle protein catabolism and promoting body protein and fat accumulation in malnourished elderly HD patients (14).

Similarly, Cherry and Shalansky studied the efficacy of IDPN in 24 HD patients. The duration of the IDPN was a mean of 4.3 months. Dry weights were significantly improved at six, nine and twelve months after therapy with a median dry BW starting at 48 kg (range of 34 – 88 kg), six months prior to IDPN initiation and resulting in a dry BW of 53.8 kg (range of 32.6 – 79 kg) at twelve months of therapy. Adverse effects were primarily fluid gains and hyperglycemia. The researchers concluded that IDPN

significantly increased BW and serum albumin in malnourished HD patients (15). Another study on IDPN in patients with MICS found that IDPN increased BW in those patients but did not affect inflammatory status or lipid levels. This led authors to conclude that IDPN is a safe and effective way to treat malnutrition in patients with MICS (16).

Korzets et al, studied the use of IDPN in acutely ill HD patients. Twenty-two HD patients received IDPN after major surgery or medical illness. IDPN was deemed safe for all patients with weight loss ceasing after two months of treatment. The researchers also showed significant improvements in albumin, prealbumin, cholesterol and creatinine levels. They concluded that IDPN can be used safely in HD patients who are acutely ill (17).

Finally, Pupim et al, hypothesized that IDPN would increase the albumin fractional synthetic rate in chronic HD patients. Seven patients were studied during two HD sessions with and without IDPN. The results indicated that patients receiving IDPN showed significant improvement in the fractional synthetic rate of albumin during dialysis. The researchers concluded that IDPN improved protein status in the acute setting in HD patients (18).

Patient Case

The patient is a 52 year old female with a medical diagnosis of CKD stage 5 with initiation of HD. She has a medical history of diabetes mellitus type 2, leukopenia, stroke with right-sided hemiparesis, congestive heart failure, dysphagia, aspiration pneumonia, and mitral regurgitation. Her diet upon hospital discharge was a diabetic/renal diet of pureed consistency with honey-thick liquids. Medications on discharge are listed in Table 1.

The patient had her first outpatient HD treatment on November 6, 2008. The renal dietitian met with the patient's caregiver, which was her sister. The patient lived with her sister and all meals were prepared by the aforementioned. The patient was non-communicative and unable to care for herself. A food-frequency questionnaire was completed with the caregiver to assess energy, protein, fluid and nutrient relevant mineral intake. A weight history revealed that the patient had lost a significant amount of weight over the previous two years, an estimated 80 kg with a drastic reduction in BMI from 47 kg/m^2 down to 28 kg/m^2. This reduction in weight was associated with the caregiver's attempt to improve the patient's blood sugar regulation.

Lab results on discharge, as indicated in Table 2, were remarkable for hyponatremia, significant hypoalbuminemia, mild depletion of calcium (corrected calcium of 8.48 mg/dL), hypophosphatemia, low iron saturation and anemia with low hemoglobin. Anthropometrics can be summarized in Table 3.

Nutrition diagnosis for this patient at the time of her initial

Table 1
Medications with Dosages and Indications for Use

Medication	Dosage	Indications for Use
Ferrous Sulfate	325 mg daily	Anemia or renal disease
Vitamin C	1000 mg daily	Erythropoiesis
Prandin	0.5 mg t.i.d. before meals	Diabetes Mellitus
Levothyroxine	200 mcg daily	Hyperthyroidism
Levemir	8 units AM	Diabetes Mellitus
Aspirin	81 mg daily	Heart disease
Colace	50 mg b.i.d.	Constipation
Nephrocaps	1 daily	Vitamin supplement for CKD patients
Phoslo	3 capsules with each meal t.i.d.	Hyperphosphatemia
Midodrine	5 mg before each dialysis	Hypotension during dialysis
Aranesp	Per dialysis protocol	Erythropoetin stimulating agent

Table 2
Laboratory Results on Hospital Discharge

Laboratory	Result	Recommended Range for CKD
Urea Reduction Ratio	69.4 %	>65 %
Blood Urea Nitrogen	36 mg/dL	50- 100 mg/dL
Creatinine	2.20 mg/dL	≥10 mg/dL
Sodium	127 mEq/L	132-145 mEq/L
Potassium	4.8 mEq/L	< 5.5 mEq/L
Glucose	155 mg/dL	70 – 110 mg/dL
Albumin	1.9 g/dL	≥ 4.0 g/dL
Calcium	6.8 mg/dL	8.5 – 10.5 mg/dL
Phosphorus	2.8 mg/dL	3.5 – 5.5 mg/dL
Parathyroid Hormone	152 pg/mL	150 – 300 pg/mL
% Saturation	12 %	≥ 20 %
Iron	19 ug/dL	28 – 170 ug/dL
Ferritin	247 ng/mL	≥ 100 ng/mL
Hemoglobin	7.1 g/dL	11 – 12 g/dL

Table 3
Anthropometrics on Discharge

Height	138 cm, 54.3 inches
Weight	55 kg
Usual body weight	90 kg, BMI 47
% of usual body weight	61 %
BMI	28 kg/m^2
% Standard body weight (SBW) according to NHANES II	Unable to assess due to small stature
% of SBW	Unable to assess
Ideal body weight (target BMI 24)	45.7 kg
% of IBW	120 %
Adjusted Body Weight (ABW) Based on K/DOQI Adjusted Edema-Free Body Weight = BWef +[(SBW – BWef) x 0.25]	52.6 kg

outpatient dialysis treatment was determined to be: Increased nutrient needs related to catabolic illness (CKD stage 5 with HD) as evidenced by hypoalbuminemia, hypophosphatemia, anemia, weight loss of > 10 % in 6 months, and food and nutrition-related knowledge deficit of the caregiver.

A nutrition prescription was identified as follows:

- 1500 – 1850 kcals (30 – 35 kcals/kg of ABW)
- 60 – 65 g protein (1.2 g/kg of ABW)
- 2000 mg sodium, 2000 mg potassium, 1000 mg phosphorus, 1500 ml fluid (20)

Following the nutrition prescription, interventions were implemented. These included a Nepro (Abbott Nutrition, Columbus, OH) supplement daily. Nepro provides 19.1 g protein, 425 calories, 250 mg of potassium, and 170 mg phosphorus. Beneprotein (Nestle Nutrition, Florham Park, NJ) was also initiated at home three times per day to provide 18 g of protein, 75 calories and 105 mg of potassium. Nutrition education was provided to the caregiver on the purpose and procedure of the nutrition intervention to improve the patient's nutritional status. At this time, the patient's diet consistency was advanced via rehabilitation with a speech therapist, so that she was now on regular textured food with thin liquids.

The following were monitored as indicators of progress. First the protein profile was monitored with a goal to attain an albumin of > 4 g/dL in MHD (as per the K/DOQI guidelines). Due to the patient also having hypophosphatemia, electrolyte and renal profiles were closely monitored. Dry weight was recorded monthly. Food and nutrition knowledge of the caregiver was utilized to monitor nutrition education results.

Summary of Results

Albumin increased from 1.9 g/dL in November of 2008 to 2.6 g/dL in April of 2010. Weight decreased from an initial weight of 55 kg in November of 2008 to 39 kg in April of 2010. These results can be visualized in Figures 1 and 2. Interventions were unsuccessful to improve albumin to a target level of > 4 g/dL and to stabilize weight between 50 – 55 kg. The caregiver had a basic understanding of the guidelines relevant to the patient's needs and was able to consistently apply knowledge to increase the patient's protein intake, especially with providing oral supplements. However, there remained a need for increasing the patient's energy intake.

Nutrition Outcomes

Figure 1. Serum Albumin Results

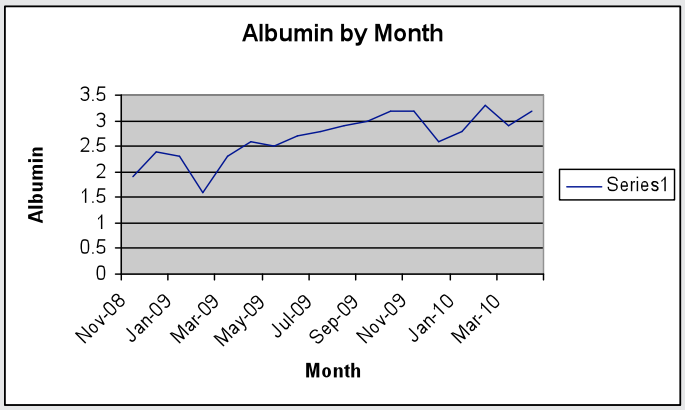
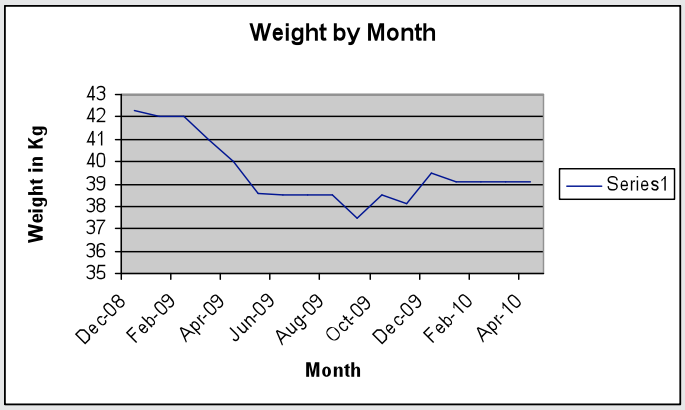


Figure 2. Dry Weight



As a result of these outcomes, a new nutrition diagnosis was formulated as follows: malnutrition related to physiological cause: increased nutrient needs of CKD stage 5 with HD and food given to the patient due to lack of knowledge on the part of the caregiver of the amount of energy and protein required as evidenced by weight loss of 29% in approximately 16 months and inability to achieve target albumin level of 4 g/dL.

A nutrition prescription was identified as follows:

- 1200- 1400 kcals (30 – 35 kcals/kg of ABW)
- 60 – 70 g protein (1.2 – 1.3 g/kg of ABW)
- 2000 mg sodium, 2000 mg potassium, 1000 mg phosphorus, 1500 ml fluid (20)

On 5/13/2010 IDPN was initiated with the following formulation: 300 mL of amino acids 15 % to provide 45 grams of protein, 50 mL of dextrose to provide 35 grams of carbohydrate. No lipids were provided.

Nutrition interventions were continued and IDPN was initiated. The patient's IDPN provided with approximately 300 kcals and 45 g protein, three times per week for a weekly total of 900 calories and 135 g protein.

The following treatment schedule was followed: Tuesday, Thursday, and Saturday with the patient receiving IDPN therapy for 3.5 hours. Table 4 reflects the IDPN provision.

Treatment Protocol for IDPN included a weekly draw of serum potassium, phosphorus and magnesium to assess for possible refeeding syndrome. Point-of-care blood sugars were also to be drawn prior to infusion of IDPN, 2 hours into therapy, and post-IDPN therapy to manage issues of hyper/hypoglycemia.
An insulin sliding scale was ordered by the unit nephrologist.

Summary of Results

Figures 3 and 4 depict results from IDPN therapy. The patient's weight increased from 39.4 kg in April to 40.3 kg and stabilized at 40.1 kg, from July to September with onset of IDPN therapy in May. Albumin increased from 3.2 g/dL in May to 3.6 g/dL in September. There were no signs and symptoms of intolerance from five months of IDPN as evidenced by blood sugars well controlled in the mid-100 range. The caregiver now has a moderate level of understanding of the patient's needs. She can consistently apply nutrition knowledge in food preparation and cooking, providing adequate portions, and meal/snack planning. Oral supplements and diet counseling were not able to arrest weight loss and increase albumin level to the desired range.

The addition of IDPN did successfully stabilize weight,

Nutrition Outcomes

Figure 3. Serum Albumin

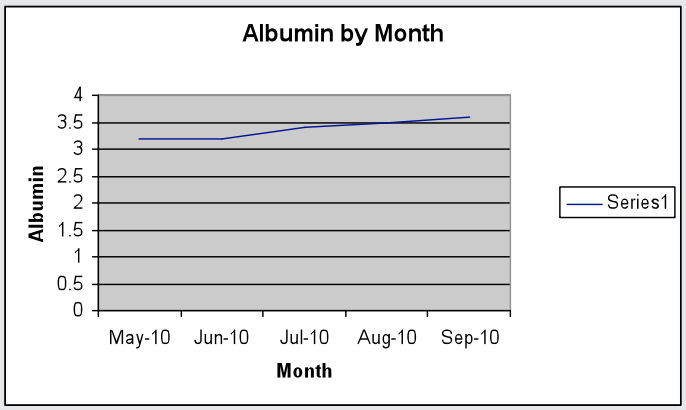


Figure 4. Dry Weight

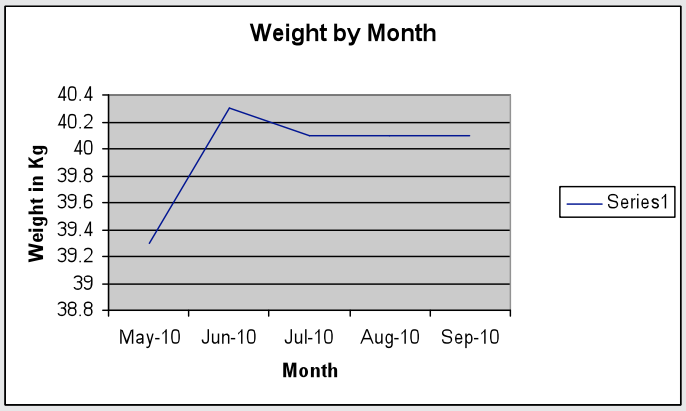


Table 4
IDPN Schedule

Treatment #	Volume in Bag	Rate per Hour	Total Volume Scheduled
5/13	350 mL	44 mL	175 mL (waste 175 mL)
5/15	350 mL	66 mL	175 mL (waste 175 mL)
5/18	350 mL	100 mL	350 mL (use entire bag)

although weight did not increase to the goal range of 50 – 55 kg. Albumin did not reach the target of 4 g/dL and perhaps more time was needed with IDPN for this to be accomplished.

Discussion and Conclusion

This case demonstrates that, in this patient, IDPN was a safe and efficacious tool for improving albumin levels and attenuating weight loss. Dukkipati and colleagues in 2009 attempted in their review to answer the question of whether nutrition support in MHD patients can effectively prevent or improve PEW. After extensive review of the literature, they concluded that there is a role for IPDN in the nutritional support of MHD. However, they commented on the lack of large randomized controlled trials on the effectiveness of IPDN in preventing morbidity and mortality as well as improving quality of life (21).

The patient was provided with a nutrition diagnosis of PEW, perhaps better termed as protein-energy wasting in individuals with CKD maintained on HD. As studies have demonstrated, PEW can lead to increased risk of mortality in patients with CKD (2). Inadequate protein intake as well as suboptimal albumin levels have also been linked to increased mortality risk in patients with CKD (3,4).

Finally, improvements in albumin level, even as minute as 0.1 g/dL have been linked with improvement in survival and averted hospitalizations in MHD patients (22). Lacson et al, utilized the Fresenius Medical Care North America database to estimate the effect of albumin concentrations on hospitalization, mortality and Medicare end-stage renal disease program costs. The population examined was a very large group consisting of 77,205 MHD patients. Based on a theoretical model, they were able to project 415 saved lives, 2,165 averted hospitalizations and 15 million dollars in cost savings from an improvement of albumin as little as 0.1 g/dL. In their model, improvements in survival, averted hospitalizations and dollars saved grow concurrent with improvements in albumin levels (22). The expected reversal of PEW in this particular patient may lead to less hospitalizations and increased longevity.

This case serves as an example of the positive results achievable in the malnourished HD population by way of medical nutrition therapy in the form of nutrition education, oral supplementation and finally IDPN. Malnutrition is prevalent in MHD patients, with as much as 25% of the HD population suffering from severe malnutrition (13). Documented cases of positive results from administration of IDPN can encourage more dialysis units to attempt this type of nutrition intervention with patients considered at nutritional risk. In the end, larger scale, controlled trials are needed to establish the effect of IDPN on PEW in HD patients as many reviewers have lamented the paucity of larger, well-designed, controlled trials on IDPN. ◆

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