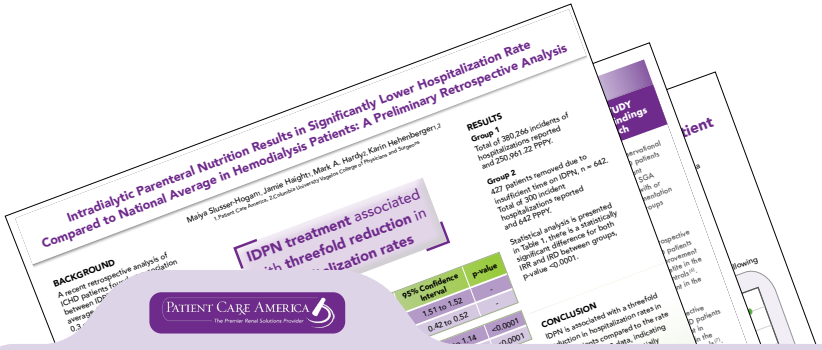
PATIENT CARE AMERICA

The Premier Renal Solutions Provider



Publication Portfolio

Scan to find our research

Office: **(866) 348-0441** | Fax: (888) 503-6982 | **pcacorp.com**

THE IDPN IMPACT STUDY

Malnutrition in Hemodialysis

Protein-energy malnutrition can occur in up to 54% of dialysis patients[1]. Malnutrition is associated with increased hospitalizations, longer hospital stays, and higher hospital readmission rates[2].

Assessing Malnutrition

Albumin is a readily available blood marker used to screen patients for possible malnutrition. Albumin levels <3.5g/dL are associated with 2x increased risk of mortality. This risk grows as albumin continues to decline[3].

Diagnosis of malnutrition can be confirmed by using tools validated for dialysis: the 7-point Subjective Global Assessment (SGA) or Malnutrition Inflammation Score (MIS).

Combatting Malnutrition with IDPN

Improving albumin in increments of 0.2g/dL has been connected to reduced risk of mortality and morbidity, and healthcare costs[3].

NutriRite® Intradialytic parenteral nutrition (IDPN) is a non-invasive, precision medicine infusion unique to HD providing protein, low dextrose, and lipids (as needed) to improve nutrient and calorie balance for malnourished HD patients.



A 5-year retrospective study evaluated 2,270 malnourished in-center hemodialysis patients receiving Intradialytic Parenteral Nutrition across 1,039 dialysis clinics in 43 states and Washington, D.C.[4]

IDPN IS EFFECTIVE

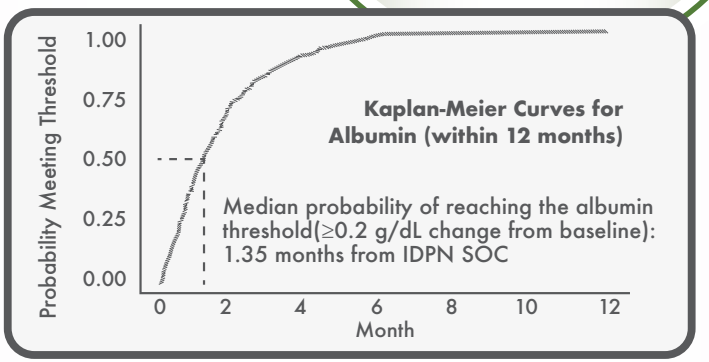
- Clinically meaningful improvement in albumin levels* were seen in 82.0% of patients within 6 months, and the average improvement, was 0.330 g/dL

IDPN IS SAFE

<8% of patients reported minor, treatable side effects

IDPN WORKS FOR A DIVERSE HD POPULATION

- Mean dialysis duration 3.7 years
- Median age 69 years old
- Equal distribution of males, females, with diverse racial, ethnical and comorbid backgrounds



THE IDPN IMPACT STUDY is consistent with the findings from other research

- Gurlek et al: A 12-month observational study of 56 malnourished HD patients found a more robust significant improvement of albumin and SGA scores with the use of IDPN with or without oral nutrition supplementation (ONS) when compared to groups receiving only ONS or only nutrition counseling[5].
- Kittiskulnam et al: 6-month prospective study of 38 malnourished HD patients found significant albumin improvement and sustained improved appetite in the IDPN group compared to controls[6]. Average albumin improvement in the IDPN group was 0.3g/dL.
- Marsen et al: 16-week prospective study of 107 malnourished HD patients found significant improvement in prealbumin and SGA scores in the IDPN group compared to controls[7].

SCAN QR CODE TO DOWNLOAD THE FULL PAPER

Intradialytic Parenteral Nutrition During In-Center Hemodialysis of Patients Leads to Increase in Albumin Without Compromising Safety: Retrospective Analysis, sponsored by Baxter Healthcare Corporation, Clinical Nutrition Division.

*1,631 eligible patients consented and were eligible for the study. Clinically meaningful improvement is an increase of at least ≥0.2 g/dL.

Intradialytic Parenteral Nutrition Reduces Recurrent Hospitalizations in Hemodialysis Patients

Maiya Slusser-Hogan[1] • Darina Kirilina[2] • Chunhui Wang[2] • Alice Baganha Sabatino[3] • Carla Maria Avesani[3] • Alison Steiber[4] • Peter Stenvinkel[3] • Paul A. Kurlansky[2] • Denis Fouque[5] • Mark A. Hardy[2] • Karin Hehenberger[1,2]

BACKGROUND

- IDPN (intradialytic parenteral nutrition) has been shown to improve serum albumin – a strong surrogate marker of hospitalization risk in patients on hemodialysis (HD).
- Real-world outcomes data remain limited.
- This study evaluated the association between IDPN use and recurrent hospitalizations in a large ICHD (in-center hemodialysis) cohort.

METHODS

- Observational, longitudinal study; 12-month follow-up.
- IDPN cohort: ICHD 3×/week + concurrent IDPN, May 2018–Apr 2023 (proprietary U.S. database).
- Comparator: USRDS 2018–2020 via stepwise selection; IPTW (inverse probability of treatment weighting) balanced baseline characteristics.
- Recurrent hospitalizations: Wei–Lin–Weissfeld (WLW) marginal model – a Cox model stratified by event order, each event as a separate process.
- Analyses conducted in R v4.3.1.

RESULTS

5.6× lower risk of recurrent hospitalization for IDPN-treated vs. USRDS (United States Renal Data System) patients at both 6 months and 1 year (both $p < 0.001$).

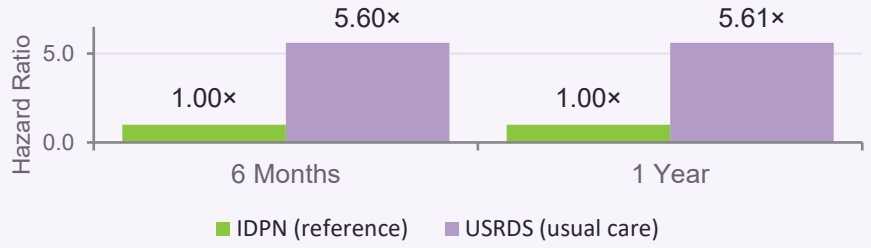
Effective N after IPTW = 6,771 (994 IDPN • 5,778 USRDS)

Table 1. Baseline Characteristics After IPTW

Variable	Overall	IDPN	USRDS	SMD
N	6,771	994	5,778	—
Age, yrs, median [IQR]	69 [59, 77]	69 [60, 77]	69 [59, 77]	0.021
Male sex, %	50.2	50.1	50.2	0.004
Diabetes, %	64.3	66.5	63.9	-0.057
Hypertension, %	85.7	85.3	85.8	0.011
Anemia, %	59.2	63.6	58.5	-0.105
Albumin, g/dL, median [IQR]	3.00 [2.80, 3.13]	2.96 [2.67, 3.17]	3.00 [2.80, 3.13]	0.092

Race/ethnicity and BMI were also balanced (all SMD < 0.10). SMD < 0.10 generally indicates adequate balance after IPTW.

Risk of Recurrent Hospitalization: USRDS vs. IDPN



CONCLUSIONS

- IDPN treatment was strongly associated with a substantial reduction in recurrent hospitalization risk among patients undergoing ICHD.
- These findings support IDPN as an effective nutritional intervention that may reduce healthcare utilization and associated costs in appropriately selected patients.

KEY DEFINITIONS

- IDPN (intradialytic parenteral nutrition)
- ICHD (in-center hemodialysis)
- HD (hemodialysis)
- IPTW (inverse probability of treatment weighting)
- SMD (standardized mean difference)

ASN Kidney Week 2026: Poster Session PO0801-4 • Poster Board SA-PO1081 • October 24, 2026
Contact: Karin Hehenberger, MD, PhD, Karin@Lyfebulb.com • Maiya Slusser-Hogan, MS, RDN, CD, CNSC, mslusser@pcacorp.com

[1]Patient Care America, FL • [2]Columbia University Medical Center and NY Presbyterian Hospital, NY • [3]Karolinska Institutet, Sweden • [4]Academy of Nutrition and Dietetics, IL • [5]Hôpital Lyon Sud, Hospices Civils de Lyon, France

Intradialytic Parenteral Nutrition Results in Significantly Lower Hospitalization Rate Compared to National Average in Hemodialysis Patients: A Preliminary Retrospective Analysis

Maiya Slusser-Hogan[1], Jamie Haight[1], Mark A. Hardy[2], Karin Hehenberger[1,2]
1.Patient Care America, 2.Columbia University Vagelos College of Physicians and Surgeons

BACKGROUND

A recent retrospective analysis of ICHD patients found an association between IDPN treatment and an average Alb improvement of 0.3 g/dL.[1] Since albumin is a strong surrogate marker for hospitalization risk, it is reasonable to postulate that IDPN may reduce incident hospitalizations.

Here, we present results of a retrospective analysis of hospitalization rates reported in a cohort of ICHD patients receiving IDPN compared to reported national averages in patients on hemodialysis (USRDS ADR).

METHODS

Group 1 consists of HD patients in the 2024 United States Renal Data System Annual Data Report (USRDS ADR) analysis.[2]

Group 2 included 1,069 patients who initiated IDPN between May 2018 and April 2023 with a 3-month average baseline albumin <3.5 g/dL. [1]Inclusion criteria: ≥12 months of IDPN treatment.

Incidents of hospitalizations were recorded over 12 months. Hospitalizations per person-year (PPPY) were determined for both groups, the Incidence Rate Ratio (IRR) and Incidence Rate Difference (IRD) were calculated using MedCalc Software Ltd., version 23.4.[3]

IDPN treatment associated with **threefold reduction** in **hospitalization rates**

	Results	95% Confidence Interval	p-value
Incidence Rate Group 1 (USRDS ADR)	1.52	1.51 to 1.52	-
Incidence Rate Group 2 (IDPN)	0.47	0.42 to 0.52	-
Incidence rate difference (IRD)	1.05	0.95 to 1.14	<0.0001
Incidence rate ratio (IRR)	3.24	2.90 to 3.64	<0.0001

References

- 1. Slusser-Hogan, M., Haight, J., Gabriel, L., Hardy, M. A., & Hehenberger, K. (2025). Intradialytic Parenteral Nutrition During In-Center Hemodialysis of Patients Leads to Increase in Albumin Without Compromising Safety: *Retrospective Analysis. Kidney360*, 10-34067.
- 2. United States Renal Data System. 2024 USRDS Annual Data Report: *Epidemiology of kidney disease in the United States*. National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, MD, 2024.
- 3. MedCalc Software Ltd. Comparison of two rates. https://www.medcalc.org/en/calc/rate_comparison.php (Version 23.4; accessed November 13, 2025)

RESULTS

Group 1
Total of 380,266 incidents of hospitalizations reported and 250,961.22 PPPY.

Group 2
427 patients removed due to insufficient time on IDPN, n = 642. Total of 300 incident hospitalizations reported and 642 PPPY.

Statistical analysis is presented in Table 1, there is a statistically significant difference for both IRR and IRD between groups, p-value <0.0001.

CONCLUSION

IDPN is associated with a threefold reduction in hospitalization rates in ICHD patients compared to the rate in national USRDS data, indicating that IDPN may be a potentially valuable treatment to avert hospitalizations in ICHD patients leading to reduced healthcare costs.

Further research is warranted to detect other benefits of IDPN since there does not appear to be any significant risks to this treatment.

Personalized Intradialytic Parenteral Nutrition Associated with Resolution of Hypoalbuminemia in Hemodialysis Patients

Maiya Hogan1, Karin Hehenberger1, Patient Care America, Pompano Beach, FL • Funding Source: Baxter Inc.

Intradialytic parenteral nutrition (IDPN) is a non-invasive, low-burden precision medicine infusion of protein and calories only available to hemodialysis (HD) patients and is intended to improve Albumin levels and mitigating the associated risk of chronic hypoalbuminemia.[1-2]

Personalized IDPN formulations can provide high protein, on average 75-100g protein per infusion, given during the HD session, with only 30-40g dextrose, thus not a concern for hyperglycemia.

Here we observed 1157 patients initiating IDPN between May 2018 and April 2023.
All patients were referred based on criteria established by the dialysis clinic, typically meaning an ALB <3.5g/dL, weight loss >5%, and/or BMI <20kg/m^2 who were not responding to oral nutrition supplementation (ONS) and diet counseling.

All patients had 3 months of baseline ALB below 3.5g/dL indicating chronic hypoalbuminemia. Patients were observed until they reached an ALB of ≥3.8g/dL or until they discontinued therapy, whichever occurred first. Baseline demographic and clinical variables were compared using two-sample t-tests for continuous variables and chi-square tests for categorical.

Over this observation period, 42% of patients achieved an ALB of 3.8g/dL or greater within an average of 7 months. Being above 70 years old, having an average baseline ALB <3.0g/dL and having fewer days on IDPN were each associated with not achieving normal Albumin levels.

DEMOGRAPHIC	REACHED ALBUMIN 3.8G/DL	%	SD	DID NOT REACH ALBUMIN 3.8G/DL	%	SD	P VALUE
N	487	0.42		670	0.58		
Age	67.21	±78y	13.82	70.26	±70y	13.14	0.000139706
Sex (F)	244	0.50		335	0.50		
Race							0.620357519
Black or African American	156	0.32		207	0.31		
White	147	0.30		191	0.29		
Other	184	0.38		272	0.41		
Ethnicity (Hispanic/Latino)	56	0.11		75	0.11		0.680639539
Dialysis Vintage (Years)	3.09	±16	4.02	3.61	±20	3.86	0.314139529
Baseline Albumin Avg	3.07		0.30	2.99		0.32	1.52452E-05
BMI	27.1	±25.22	19.87	25.9	±44.23	6.91	0.161482241
Comorbidities							
Diabetic	351	0.72		484	0.72		0.951263627
Anemia	321	0.66		441	0.66		0.973952941
Gerd/Reflux	57	0.12		80	0.12		0.901724315
Hypertension/HTN	368	0.76		492	0.73		0.412612178
IBS/IBD/Crohns	2	0.00		5	0.01		0.477150249
Therapy Hold (Y)	87	0.18		324	0.48		0.916476974
Service Days	417.13	±730		344.74	±830		9.59845E-10

HD patients with hypoalbuminemia who are not responding to diet counseling and ONS remain at high risk for morbidity, hospitalization, and mortality.[1-2] Kalantar-Zadeh et al postulated that if all dialysis patients experiencing hypoalbuminemia, defined as ALB <3.8g/dL, could return to normal ALB levels roughly 10,000 lives could be saved annually.[2] IDPN appears to be an effective intervention for these patients and supports their return to normal Albumin levels.

References

1. Lacson Jr, Eduardo, et al. "Potential impact of nutritional intervention on end-stage renal disease hospitalization, death, and treatment costs." *Journal of Renal Nutrition* 17.6 (2007): 363-371.
2. Kalantar-Zadeh, Kamyar, et al. "Revisiting mortality predictability of serum albumin in the dialysis population: time dependency, longitudinal changes and population-attributable fraction." *Nephrology Dialysis Transplantation* 20.9 (2005): 1880-1888.

Degree and Prediction of Response to IDPN Therapy in a Large Cohort of Malnourished ICHD Patients: A Retrospective Analysis

Serum albumin (Alb) strongly predicts mortality and morbidity of in-center hemodialysis (ICHD) patients, increasing Alb has been shown to improve patient outcomes. Our study of 1631 ICHD patients on Intradialytic Parenteral Nutrition (IDPN) showed efficacy and safety in a diverse patient population. Here we evaluate a subset of that cohort to categorize degree of response.

Methods

452 HD patients: 18 years and older, receiving dialysis 3 days per week, who initiated IDPN in 2021 with a 3-month average baseline Alb <3.5g/dL, were included and followed through the first 6 months of therapy. 202 patients were removed for insufficient data **leaving a cohort of 250**.

Patients were sorted into 1 of 3 groups based on Alb at 6 months:

- Gr1: Alb decreased from baseline.
- Gr2: Alb stabilized at 0.0g/dL to <0.3g/dL.
- Gr3: Alb increased ≥0.3g/dL.

Baseline variables were compared using 1-way ANOVA or continuous variables and chi-square for categorical.

- 84% of patients responded to therapy, 61% showed an increase of ≥0.3g/dL.
- Lower baseline Alb results in greater Alb improvement.
- Peak Alb, the highest Alb reached within 6 months of therapy, was reached most often in month 6 in Gr3, with an avg of 4.3 months.
- Gr1 and Gr2 peaked in mos. 1 and 2 respectively. The average change between baseline and peak Alb in Gr1, Gr2, and Gr3 were 0.11g/dL, 0.34g/dL, and 0.72g/dL respectively.
- The no. of IDPN therapy holds had an inverse relationship with Alb improvement.
  - The no. of IDPN therapy holds did not correlate with reported side effects, p value 0.08, thus we assume the therapy holds were unrelated to IDPN.

Conclusion

Patients with lower baseline Alb who receive therapy more consistently appear to have a greater response.

Patients who are high responders appear to require at least 4.3 months of treatment.

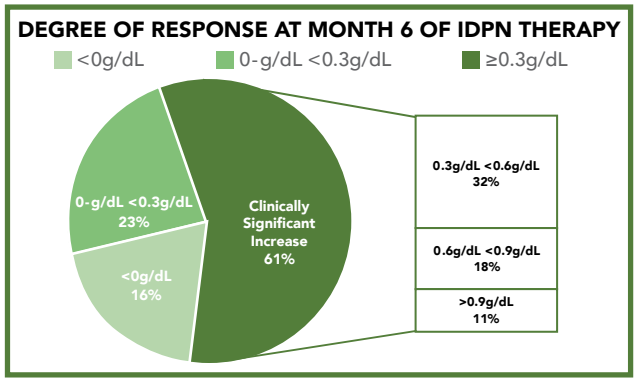
No safety concerns were observed with IDPN use.

More research on other health indicators as well as longitudinal post-IDPN clinical outcomes is needed to understand the full impact of the benefits of IDPN therapy in the ICHD population.

Total	250
Avg Age (years)	67.62
Avg Dialysis Vintage (years)	3.98
Women	113
Men	137
White	72
Black/African American	69
Unstated Race	109

Medical History	
Anemia	186
GERD	36
Hypertension	196
Diabetes	**173**
Type 1	76
Type 2	97
Patients Reporting Side Effects (n)	18

	Gr1			Gr2			Gr3			
Results		%	Range		%	Range		%	Range	p-value
Number of Patients per Group	40	16%		56	23%		154	61%		
Avg Baseline ALB (g/dL)	3.10		±0.8	3.00		+1.4	2.90		±$1.9	**<0.001**
Avg Peak Alb (g/dL)	3.20		±1.0	3.40		±1.7	3.70		±2.0	**<0.001**
Avg Alb Δ from Baseline to Peak (g/dL)		0.11%			0.34%			0.72%		**<0.001**
Avg mo. of first peak (g/dL)	2.40			2.90			4.30			**<0.001**
Patient placed on hold (n)	21.00	53%		30.00	54%		58.00	38%		**0.056**
Avg # of IDPN Holds	1.00			0.90			0.61			**0.038**



1. Patient Care America, 2. Columbia University

Slusser-Hogan M, Haight J, Hardy MA, Hehenberge K: Degree and Prediction of Response to Intradialytic Parenteral Nutrition Therapy in a Large Cohort of Malnourished Patients on In-Center Hemodialysis: A Retrospective Analysis [FR-PO1089] J Am Soc Nephrol 36, 2025: doi: 10.1681/ASN.20253zp25ecx

IDPN Effectively Improves Albumin Levels in Hemodialysis Patients Prior to Kidney Transplantation

Maiya Slusser-Hogan[1], Jamie Haight[1], Mark A. Hardy[2], Karin Hehenberger[1,2]
1. Patient Care America, 2. Columbia University

Background

Low albumin (Alb) levels prior to kidney transplantation are associated with poor long-term allograft outcomes and an increase in post-transplant complications including increased risk for BKV.[1,2] Optimizing Alb status while recipients await renal transplants can be supported with targeted individualized nutrition treatments. IDPN has been identified as a safe and effective complementary treatment for refractory hypoalbuminemia for patients on hemodialysis by raising Alb by 0.33g/dL on average within 6 months of start of treatment.[3] Here we present a descriptive analysis of IDPN patients who were discharged to transplant.

Methods

Within a database of 4152 HD patients receiving IDPN we identified 25 patients who stopped therapy due to the receipt of a kidney allograft. Demographic and Alb data were provided for a descriptive analysis. A two-sample t-test was used to compare baseline Alb level prior to initiating IDPN and Alb level near time of discharge for transplant.

Results

Of the 25 transplanted patients entered for analysis, 2 patients were removed as they deviated from the standard 3 days per week HD prescription, 3 were removed for insufficient time on IDPN, and a final 5 were removed due to insufficient laboratory or demographic data, leaving 14 transplant recipients (7 male, 7 female), average age 57yo, representing diversity in race and ethnicity, for final analysis.

Demographic results are summarized in **TABLE 1** Baseline and Study Characteristics in **TABLE 2**, and Alb levels are summarized in in **TABLE 3**.

The average improvement in albumin levels was 0.63g/dL after IDPN therapy. A t-test comparing baseline Alb level to Alb level near time of transplantation, indicated the improvement was statistically significant, p-value 0.003. Ten out of 14 patients (71.4%) achieved an albumin level of ≥3.8g/dL at the time of renal transplantation. None of the patients reported any side effects related to IDPN treatment.

Discussion and Conclusion

IDPN is a unique therapy only available to dialysis patients to treat refractory hypoalbuminemia and malnutrition that has not responded to counseling and oral nutrition supplementation. Within a cohort of 14 HD patients experiencing malnutrition, IDPN effectively and significantly increased Alb level in patients prior to receiving renal transplants (p-value 0.003). Patients receiving IDPN who discharged to transplant experienced a greater increase in albumin levels compared to IDPN patients who did not discharge to transplant, 0.63g/dL vs 0.33g/dL respectively.

By improving Alb levels prior to transplantation utilizing nutrition support, renal allograft recipients are expected to have better post-transplant outcomes and improved allograft survival. Further longitudinal research is warranted.

Demographic Results

	n	%	SD
Type 1 Diabetes	2	14.3%	-
Type 2 Diabetes	6	42.9%	-
Anemia	6	42.9%	-
Hypertension	8	57.1%	-
Gastric Bypass	3	21.4%	-
Cirrhosis	1	7.1%	-
IBS/IBD/Crohn's	2	14.3%	-

Baseline and Study Characteristics

	n	%	SD
Dialysis Duration (years)	3.27*	-	2.73
Dialysis Duration min, max	0.17, 8.38	-	-
Baseline Albumin Avg (g/dL)	3.14	-	-
Average Albumin at d/c (g/dL)**	3.77	-	-
Average BMI (kg/m2)	25.03	-	3.96
Average Time on Therapy (days)	417.8	-	254.7
Lipids (Y)	1	7.1%	-
Patients with Therapy Interruptions	3	21.4%	-
Patients with Interruptions for Hospitalization	2	14.3%	-
Patients with Interruptions for Non-hospitalization Reasons	2	14.3%	-

Albumin Levels

Study Participant	Average Baseline Albumin (g/dL)	Albumin at D/C* (g/dL)	Average Albumin on Therapy (g/dL)	Change in Albumin from Baseline to D/C (g/dL)
DCTP1	2.83	3.9	3.59	1.07
DCTP2	2.9	4.1	4.08	1.2
DCTP3	3	2.4	2.53	-0.6
DCTP4	3.1	4.1	3.81	1
DCTP5	2.43	3.1	2.97	0.67
DCTP6	3.05	3.2	3.42	0.15
DCTP7	3.2	4.9	4.32	1.7
DCTP8	3.03	4.1	4.03	1.07
DCTP9	3.68	3.8	3.78	0.12
DCTP10	4.2	3.9	4.04	-0.3
DCTP11	3	3.8	3.81	0.8
DCTP12	3.17	4.1	3.75	0.93
DCTP13	2.85	4	3.72	1.15
DCTP14	3.56	3.4	3.35	-0.16

*Average time from last available albumin to d/c date is 41 days

References

1. Yang, S. W., Choi, J. Y., & Kwon, O. J. (2013, May). The impact of pretransplantation serum albumin levels on long-term renal graft outcomes. In *Transplantation Proceedings* (Vol. 45, No. 4, pp. 1379-1382). Elsevier.
2. Srivastava, A., Bodnar, J., Osman, F., Jorgenson, M. R., Astor, B. C., Mandelbrot, D. A., & Parajuli, S. (2020). Serum albumin level before kidney transplant predicts post-transplant BK and possibly cytomegalovirus infection. *Kidney International Reports*, *5*(12), 2228-2237.
3. Slusser-Hogan, M., Haight, J., Gabriel, L., Hardy, M. A., & Hehenberger, K. (2025). Intradialytic Parenteral Nutrition During In-Center Hemodialysis of Patients Leads to Increase in Albumin Without Compromising Safety: Retrospective Analysis. *Kidney360*, 10-34067.

A Retrospective Descriptive Analysis of Adverse Events Associated with Intradialytic Parenteral Nutrition

Maiya Slusser-Hogan[1], Jamie Haight[1], Mark A. Hardy[2], Karin Hehenberger[1,2]

Introduction

IDPN is a unique form of PN available only to patients on hemodialysis (HD) as the therapy leverages the existing dialysis access site for infusion. Since research on IDPN is limited there have been few reports about its safety. A recent retrospective analysis of IDPN patients reported a 7.6% incidence of adverse events (AE) without analysis of causality.[1] More detailed information is required regarding AEs associated with IDPN. We present preliminary findings of AEs attributed to IDPN therapy reported during treatment in 1961 patients.

Methods

A database of 1961 IDPN patients was used to analyze the incidence and type of AEs during IDPN infusion. Adequate data for analysis were available in 1734 patients. Of the remaining patients, AEs were reported in 120 (6.9%). Patients with AEs were stratified into 3 groups based on time of occurrence measured from the start of care (SOC) for IDPN: Group 1 was Early AE – ≤45 days from IDPN initiation; Group 2 was Late AE – >45 days after IDPN initiation and >30 days prior to discontinuation (d/c); and Group 3 was AE D/C – AE occurs ≤30 days within IDPN d/c.

Table 1 Demographics

	Group 1: Early AE (n)	%	Group 2: Late AE (n)	%	Group 3: AE D/C (n)	%
N	20	16.67%	59	49.17%	41	34.17%
AGE Avg	70.25	-	71.98	-	69	-
Age Min-Max	44, 90	-	35, 96	-	41, 89	-
Sex Female	13	65.00%	30	50.85%	25	60.98%
Sex Male	7	35.00%	29	49.15%	16	39.02%
Race						
Black or African American	7	35.00%	15	25.42%	17	41.46%
White	6	30.00%	16	27.12%	12	29.27%
Unstated	7	35.00%	28	47.46%	12	29.27%
Dialysis Vintage (years)	3.42	-	4.58	-	3.3	-
Avg BMI	25.42	-	25.66	-	26.83	-
Diabetes (Y)	14	70.00%	43	72.88%	31	75.61%
IDDM	5	25.00%	19	32.20%	7	17.07%
NIDDM	9	45.00%	24	40.68%	24	58.54%
Anemia	14	70.00%	41	69.49%	30	73.17%
Gastroesophageal reflux disease	3	15.00%	8	13.56%	4	9.76%
Hypertension	15	75.00%	53	89.83%	33	80.49%
Residual Kidney Function	0	0.00%	3	5.08%	4	9.76%

Demographics are summarized in Table 1; results are summarized in Table 2.

Table 2 Results

	Group 1: Early AE (n)	%	Group 2: Late AE (n)	%	Group 3: AE D/C (n)	%
N	20	16.67%	59	49.17%	41	34.17%
Received LIPIDS (Y)	2	10.00%	12	20.34%	2	4.88%
Therapy Hold (Y)	20	100.00%	54	91.53%	15	36.59%
Average time on therapy (days)	340.08*	-	394.72**	-	358.75	-
D/C due to reported AE (Y)	0	-	10	16.95%	23	56%
Avg time from SOC to AE (days)	16.35	-	257.11	-	352.8	-
Avg time from AE to DC (days)	121.2	-	169.52	-	5.95	-
Type of AE						
N/V	13	65.00%	34	57.63%	14	34.15%
Diarrhea	3	15.00%	9 1	5.25%	7	17.07%
Cramps	2	10.00%	3	5.08%	0	0.00%
Bloating	0	0.00%	3	5.08%	2	4.88%
Other GI Upset	1	5.00%	10	16.95%	5	12.20%
Headache	0	0.00%	1	1.69%	0	0.00%
Rash/Hives	1	5.00%	0	0.00%	0	0.00%
Fluid Overload	0	0.00%	2	3.39%	8	19.51%
Itching	0	0.00%	1	1.69%	0	0.00%
Unspecified	4	20.00%	13	22.03%	14	34.15%

*n = 13, 7 patients without d/c dates
**n = 44, 15 patients without d/c dates

Results

AEs were reported in 120 patients (6.9%) while receiving IDPN. Patients had 1,2, or 3 different types of AEs or symptoms which are presented in Table 2. A majority (98 patients) had 1 type, while 14 had 2 types, and 8 had 3 types. Of the 120 patients, 20 were in Group 1 -Early AE, 59 were in Group 2 -Late AE, and 41 were in Group 3 - AE D/C. During the first 45 days of treatment IDPN therapy is titrated to goal rate which permitted patients to adjust to the infusion, none of the Early AEs required discontinuation (D/C) of IDPN indicating the AEs were either well tolerated or were resolved. AEs in Groups 2 and 3, >45 days after IDPN initiation, may be more indicative of a change in patient tolerance to IDPN or to dialysis in general. A total of 33 patients reported discontinuing IDPN therapy due to intolerance, and all fell into Group 2 the Late AE, n = 10, or into Group 3 AE D/C, n = 23. Average time on IDPN therapy was comparable among groups at 340.08, 394.72, and 358.75 days for Group 1 Early AE, Group 2 Late AE, and Group 3 AE D/C respectively.

Conclusion

AEs attributed to IDPN therapy occur only in a small percentage of IDPN patients. In our cohort of 120 patients with AEs out of 1734 patients studied, 83.34% of events occurred >45 days after IDPN initiation and may be more indicative of an overall change in patient health as compared to AEs caused by IDPN therapy itself which is rare. Early AE which are more likely to be associated with IDPN therapy itself occurred only in 20 patients and none discontinued IDPN therapy. This indicates that their AEs were well tolerated or resolved. Further causality analysis of AEs during IDPN therapy is warranted.

References

1. Slusser-Hogan, M., Haight, J., Gabriel, L., Hardy, M. A., & Hehenberger, K. (2025). Intradialytic Parenteral Nutrition During In-Center Hemodialysis of Patients Leads to Increase in Albumin Without Compromising Safety: Retrospective Analysis. *Kidney360*, 10-34067.

Intradialytic Parenteral Nutrition Positively Impacts Albumin in Hemodialysis Patients with Cirrhosis

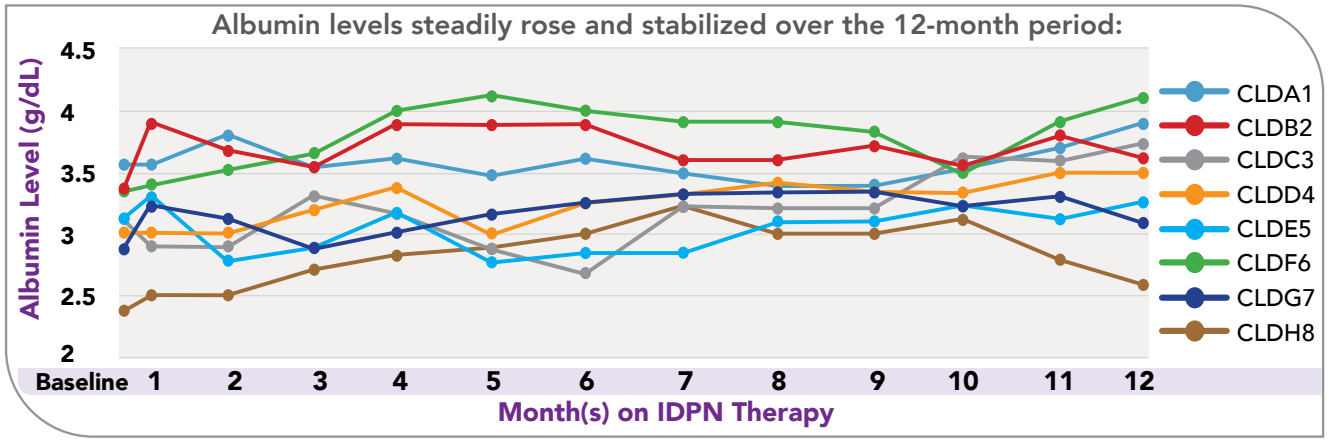
Special thanks to Maiya Hogan, MS, RDN, CD, CNSC who supported, encouraged, guided and contributed to this poster.

Liver cirrhosis is associated with an increased risk of protein-energy malnutrition, poor quality of life, and increased healthcare burden. For people on dialysis with comorbid liver cirrhosis, meeting nutritional needs can be difficult due to loss of appetite, decreased functional capacity, and increased metabolic demands leaving them especially vulnerable to the development of protein energy wasting (PEW) and increasing morbidity and mortality risk.

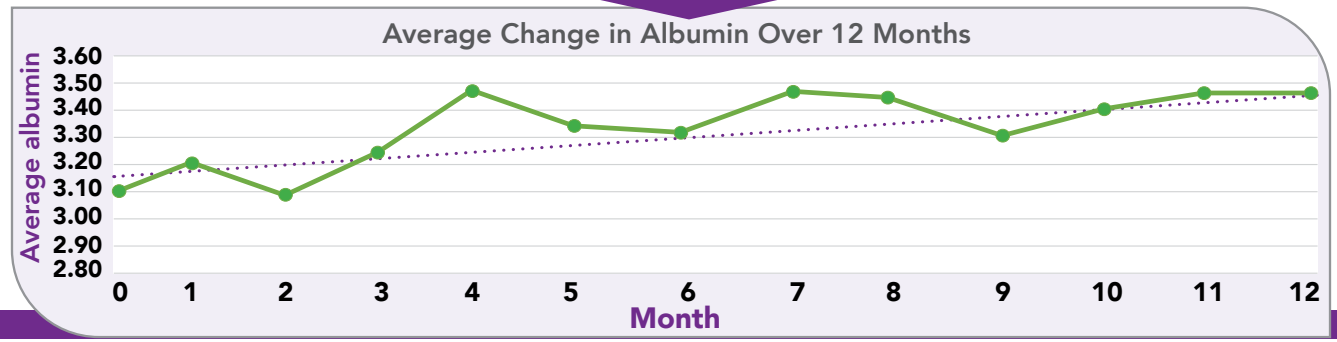
Research has indicated that parenteral nutrition can be utilized to combat PEW in nutritionally compromised patients with liver disease. Dialysis patients have access to a unique and non-invasive form of parenteral nutrition (PN) via Intradialytic Parenteral Nutrition (IDPN) which is able to deliver a combination of amino acids, dextrose, and lipids as needed through the dialysis access site while the patient receives hemodialysis (HD) treatment.

8 HD patients were observed over the course of IDPN treatment for 12 months:

Demographics		Pre-IDPN Mean	12 Month Mean	Mean Change
4M, 4F Mean age 63.4 years Mean Dialysis Vintage 3 years	Albumin Level (g/dL)	3.09 ± 1.3	3.46 ± 1.5	0.37 ± 0.97



CONCLUSION: A t-test was run to compare albumin prior to initiation of IDPN therapy and at 12 months. The improvement of albumin was found to be statistically significant (p value 0.001). IDPN may be a valuable tool in combatting PEW and the related negative effects in patients with comorbid end stage renal disease and liver cirrhosis.



References

- Johnson, T. M., Overgard, E. B., Cohen, A. E., & DiBaise, J. K. (2013). Nutrition assessment and management in advanced liver disease. *Nutrition in Clinical Practice, 28*(1), 15-29.
- European Association For The Study Of The Liver. (2019). EASL Clinical Practice Guidelines on nutrition in chronic liver disease. *Journal of hepatology, 70*(1), 172-193.
- Sharma, A., & Nagalli, S. (2021). Chronic liver disease. *In StatPearls [Internet].* StatPearls Publishing.
- Simonetto, D. A., Gines, P., & Kamath, P. S. (2020). Hepatorenal syndrome: pathophysiology, diagnosis, and management. *bmj, 370*Slusser-Hogan, M. (2024). 455 intradialytic parenteral nutrition positively impacts albumin in hemodialysis patients with cirrhosis. *American Journal of Kidney Diseases, 83*(4), S140. https://doi.org/10.1053/j.ajkd.2024.01.458

Experience and Observations Using IDPN Therapy in Complex Hemodialysis Patient

Background

60yo Caucasian female, dialysis vintage 6 years presenting with signs of malnutrition, reduced appetite, poor oral intake, and chronic hypoalbuminemia indicative of reduced protein synthesis.[1] Patient exhibited an aversion to meat which made it difficult for her to consume high biological value protein.

Medical history: ESRD, HTN, ETOH abuse, liver cirrhosis, anemia, protein calorie malnutrition, and plasma protein disorder related to liver disease.

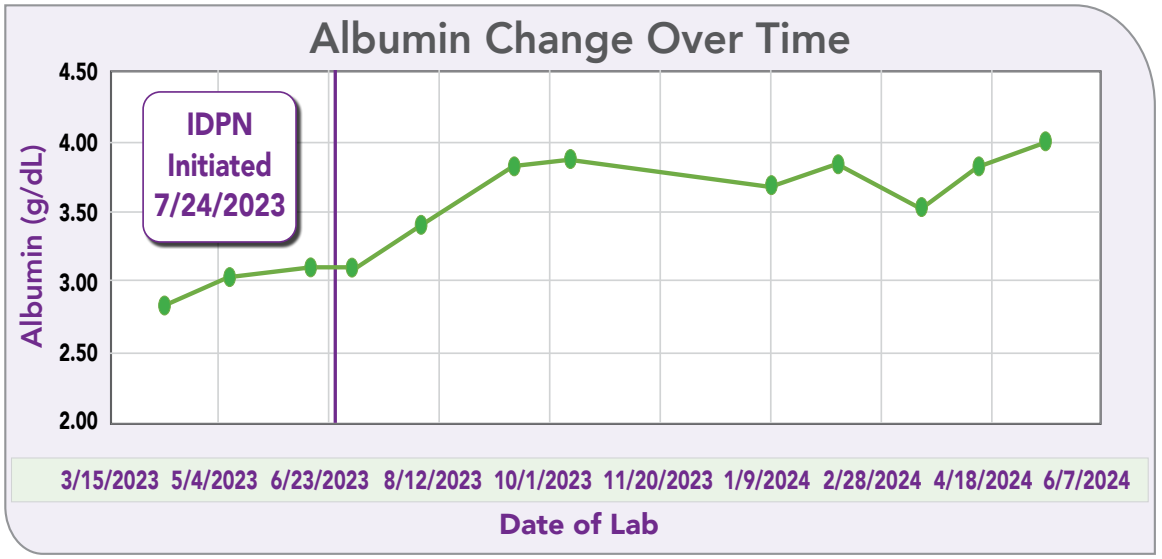
Nutrition Prescription: ongoing nutrition counseling and oral nutrition supplementation of Boost pudding and glucose control shakes.

Intervention and Results

Intradialytic parenteral nutrition (IDPN) was initiated 7/24/23. Prescription 60g AA, 30g dextrose, total calories 343 kcal, Infuvite MVI, and potassium phosphate infused over 2hr and 45m.

The patient received IDPN for 306 days during which time there were no reports of intolerance, adverse events or therapy interruptions. Albumin improved from an average of 3.0g/dL at baseline to 4.0g/dL, normal albumin, at time of discharge. During this time, the patient's clinician made the following observations of outcomes and contributing factors:

- "She is eating better gaining weight and the team is happy with her current status."
- "She reported that she felt better in general once she started IDPN. This made her more willing to continue the IDPN long-term. I also tried to reinforce high protein food sources with her that she liked."



Conclusion

At time of discharge from IDPN therapy, patient had returned to normal albumin levels which is associated with reduced risk of hospitalization and mortality.[2,3] Patient's interdisciplinary team observed positive changes and were able to resume focus on oral intake to support nutrition needs without IDPN. Improved albumin levels and appetite are associated with the use of IDPN therapy.[4,5] IDPN is a non-invasive protein therapy that can help bridge the nutrition gap for hemodialysis patients unable to meet their nutrition needs through oral intake alone.

Monique Brewah1, Sarah Voegtle[1], Maiya Slusser-Hogan[1], Patient Care America, Pompano Beach, FL

References

1. Kaysen GA, Rathore V, Shearer GC, Depner TA. Mechanisms of hypoalbuminemia in hemodialysis patients. *Kidney International*. 1995;48(2):510-516. doi:https://doi.org/10.1038/ki.1995.321
2. Uludag K, Boz G, Gunal AI. Lower serum albumin level is associated with increased risk of hospital admission and length of stay in hospital among incident hemodialysis patients by using overdispersed model. *Therapeutic Apheresis and Dialysis*. Published online August 20, 2020. doi:https://doi.org/10.1111/1744-9987.13552
3. Iseki K, Kawazoe N, Fukiyama K. Serum albumin is a strong predictor of death in chronic dialysis patients. *Kidney International*. 1993;44(1):115-119. doi:https://doi.org/10.1038/ki.1993.220
4. Kittiskulnam P, Banjongjit A, Metta K, et al. The beneficial effects of intradialytic parenteral nutrition in hemodialysis patients with protein energy wasting: a prospective randomized controlled trial. *Scientific Reports*. 2022;12(1):4529. doi:https://doi.org/10.1038/s41598-022-08726-8
5. Gurlek Demirci B, Carrero JJ, Tutal E, Bal Z, Sezer S. Effect of nutritional support on nutritional status and inflammation in malnourished patients undergoing maintenance hemodialysis. *Hemodialysis International*. Published online June 16, 2021. doi:https://doi.org/10.1111/hdi.12936

Complex Hemodialysis Patient Experiences Significant Improvement with Comprehensive, Individualized Nutrition Regimen

Case Presentation

56-year-old Caucasian male with ESRD beginning ICHD in February 2020 presenting with complex medical history including IgG4 disease with liver and possible renal involvement, poorly controlled IDDM s/p L BKA, chronic pancreatitis with chronic severe diarrhea, HTN, active MRSA in left stump, and severe malnutrition based on laboratory data, weight, BMI, and subjective report.

Despite intensive dietary counseling from the clinic Registered Dietitian and prescribed oral nutrition supplementation (ONS), his nutrition status continued to decline and diarrhea had worsened by his 90 day assessment with 3 consecutive months average albumin/nPCR of 2.7/.64, BMI 18.8. Patient initiated Intradialytic Parental Nutrition (IDPN) therapy on July 21st, 2020. IDPN prescription as follows: 20% AA, 70% dextrose to provide 75 gm protein, 35 gm CHO, 419 kcal with total volume 425 ml infused over 3 hours, 3 times weekly via dialysis access site.

Along with improvements in albumin, nPCR, weight, and BMI patient reported improvement in appetite, PO intake and energy level. Even with 7 hospitalizations r/t poorly controlled DM and infections between 6/27/20 and 10/13/21, patient's albumin remained >3.0. Patient had no further hospitalizations since October 2021.

Discussion

IgG4-related disease (IgG4-RD) is a fibroinflammatory condition that is not well understood. The disease is characterized by two key features – lymphoplasmacytic infiltration and storiform fibrosis – which commonly develops in multiple organs. Roughly 15% of patients with IgG4-RD develop kidney involvement which can lead to the occurrence of chronic kidney disease (CKD) and ultimately kidney failure. It is unclear if this patients CKD developed in whole or in part due to the presence of IgG4-RD. Nonetheless, due to multi-organ involvement it is likely patients with IgG4-RD are highly catabolic with complex nutrition needs. Due to liver involvement in our case presentation, we expect challenges in adequate production of body proteins and yet patient was able to improve albumin levels.

In addition, the patient's pancreatic insufficiency contributing to chronic diarrhea and likely malabsorption made it difficult to adequately meet nutrition needs with PO intake alone. Coupled with the catabolic effects of ESRD, diabetes, and dialysis treatment, it is understandable why the patient developed severe malnutrition based on laboratory findings, weight, BMI, and subjective data.

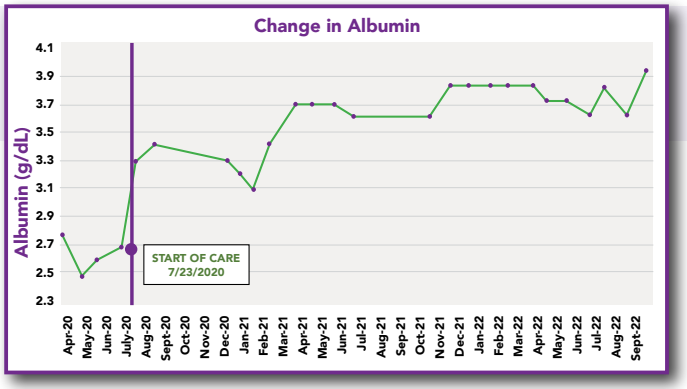
Malnutrition increases disease burden, with every 0.2g/dL reduction in albumin associated with significant increased risk of mortality. Along with increased mortality risk, malnutrition increases risk and frequency of hospitalization and increases length of hospital stays. Frequent hospitalization is costly and makes it difficult for patients to develop consistent routines around their healthcare and medical management.

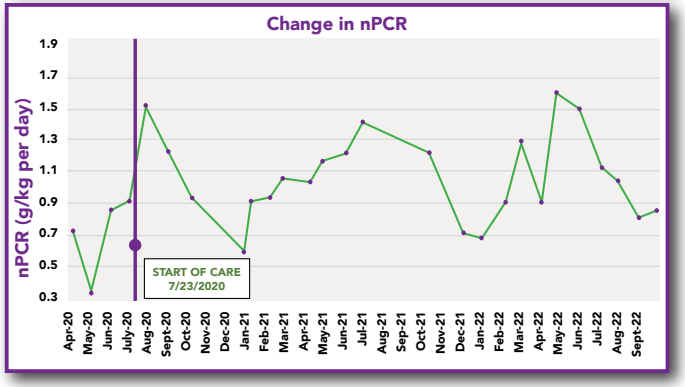
Conclusion

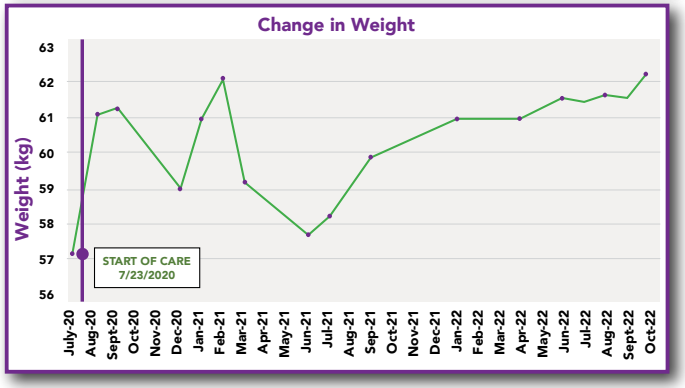
When patients are severely malnourished, they become hypercatabolic, often develop anorexia, and experience other challenges preventing adequate reliable nutrition from first line treatments. This makes access to IDPN therapy a valuable asset to patients on hemodialysis especially those with complex comorbidities and who do not want more invasive treatments such as enteral nutrition and total parenteral nutrition. By introducing IDPN to this patient's nutrition regimen, he significantly improved multiple markers of nutrition and health and tolerated therapy well with no reported side effects.
Per facility RD, patient now has improved fluid management and A1c levels, is showing more independence and a greater interest in self-care and medication management. Patient recently enjoyed a vacation and has his first transplant evaluation appointment scheduled for 2/1/23.

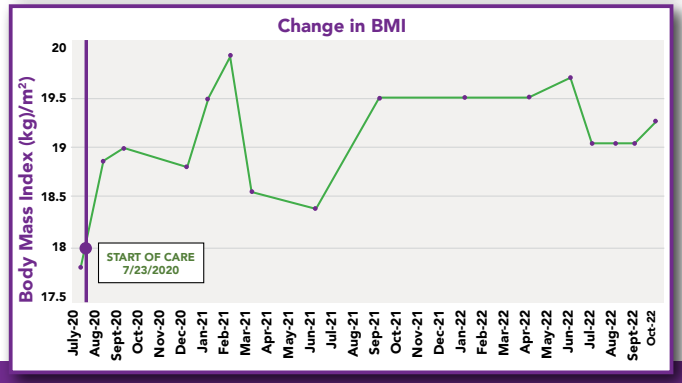
Date	Albumin	nPCR	Weight	BMI
4/9/20	2.8	0.72	N/A	N/A
5/12/20	2.5	0.37	N/A	N/A
6/4/20	**2.6**	**0.82**	**N/A**	**N/A**
Jul-20	**2.7**	**0.95**	**57.5**	**17.89**
Aug-20	3.3	1.53	61.1	18.9
Sep-20	**3.4**	**1.28**	**61.3**	**19**
Dec-20	3.3	0.64	59.2	18.9
Jan-21	3.2	0.97	61	19.5
Feb-21	3.1	1	62	19.83
Mar-21	**3.4**	**1.16**	**59.3**	**18.7**
Jun-21	3.7	1.35	58	18.55
Jul-21	3.6	1.58	58.5	18.56
Nov-21	3.6	1.23	N/A	N/A
Jan-22	3.8	0.73	61	19.5
Apr-22	3.8	1.01	61	19.5
Jun-22	3.7	1.69	61.5	19.67
Jul-22	3.6	1.25	61.4	19.1
Aug-22	3.8	1.15	61.6	19.1
Sep-22	3.6	0.9	61.5	19.1
Oct-22	3.9	0.94	62.1	19.3

IDPN Start of Care
Hospitalization









References

- Kamisawa, Terumi, et al. "IgG4-related disease." *The Lancet* 385.9976 (2015): 1460-1471.
- Pupim, Lara B., et al. "Intradialytic parenteral nutrition improves protein and energy homeostasis in chronic hemodialysis patients." *The Journal of clinical investigation* 110.4 (2002): 483-492.
- Lacson Jr, Eduardo, et al. "Potential impact of nutritional intervention on end-stage renal disease hospitalization, death, and treatment costs." *Journal of Renal Nutrition* 17.6 (2007): 363-371.
- 65 Complex ICHD. "Patient Improves with Tailored Nutrition Regimen." *American Journal of Kidney Diseases*, Volume 81, Issue 4, S19.

Kathryn Collins1, Maiya Slusser1

Intraperitoneal Nutrition Associated with Improved Albumin Levels in Malnourished Patients on Peritoneal Dialysis

Malnutrition and hypoalbuminemia occur in 30%-50% of people receiving peritoneal dialysis (PD) treatment and is associated with poor quality of life and poor health outcomes including increased risk of peritonitis, septicemia, pneumonia, and hospitalizations. Evidence suggests improving albumin levels by 0.1g/dL to 0.2g/dL can reduce the frequency of malnutrition-related challenges.

Intraperitoneal nutrition (IPN) is a unique form of peritoneal dialysis (PD) solution designed to help correct malnutrition. IPN uses a combination of amino acids and dextrose to maintain ultrafiltration while allowing amino acids to infuse during the dwell time to improve protein synthesis and replace protein lost during PD. IPN is commonly provided as a once daily, one-for-one replacement of a standard dialysis solution in the patients PD regimen.

Thirteen patients on automated PD who started on IPN therapy in 2021 were randomly selected and albumin was compared from baseline to measurements at month 3 and month 6 of IPN therapy. A t-test was run and found the results to be statistically significant at both 3 and 6 months, 0.002 and 0.0004 respectively.

Baseline Characteristics N (%)	
Mean age	62.3 years ± 50 years
Mean dialysis vintage*	10.5 months ± 16 months
Sex, female	8 (61.5%)

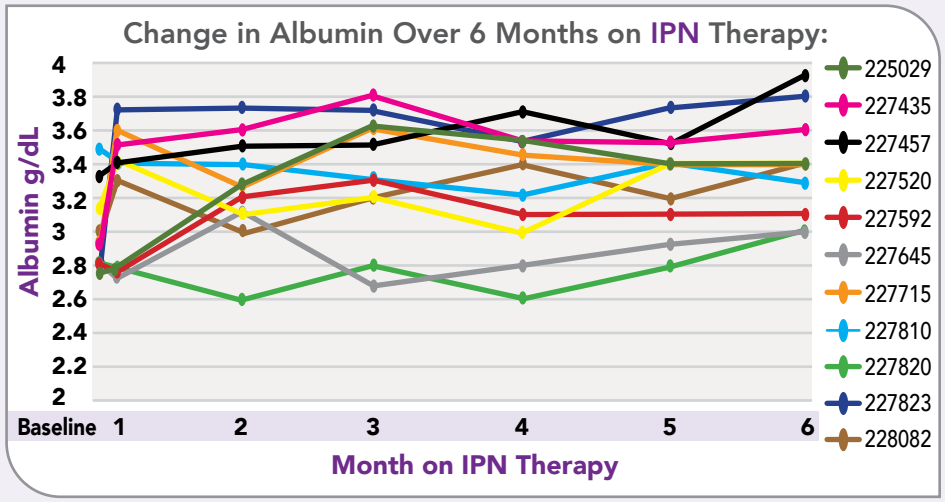
*Based on 9 records, 4 patients dialysis vintage could not be determined

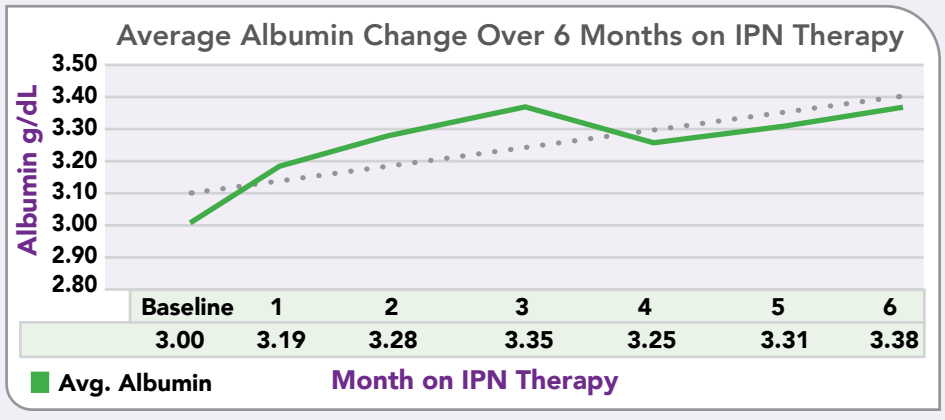
Medical history	
Diabetes	11 (84.6%)
Hypertension	11 (84.6%)
Anemia	10 (77%)
Gastroparesis	2 (15.4%)
Liver cirrhosis	1 (7.6%)
Chronic wound	2 (15.4%)

Reason for IPN Referral	
Albumin trending <3.5g/dL	8 (61.5%)
Albumin trending <3.5g/dL and weight loss ≥5% over 3 months	4 (30.7%)
Albumin trending <3.5g/dL and BMI <20	1 (7.7%)

IPN Formulation	
5L, 50g AA, DE 2.5%	2 (15.4%)
6L, 60g AA, DE 1.5%	5 (38.5%)
6L, 60g AA, DE 2.5%	6 (46.2%)
Results	Albumin (g/dL)
Pre-IPN Mean	3.00 ± 0.53
3 Month Mean	3.35 ± 1.1
6 Month Mean	3.38 ± 0.90
Mean Change at 6 Months	0.38 ± 0.95

PD results in varying protein losses and has common side effects resulting in diminished appetite and poor oral protein intake, leading to malnutrition. Malnutrition contributes to poor quality of life and costly adverse health outcomes for patients. IPN provides a non-invasive, low burden option to help correct malnutrition.





Slusser, Maiya:
Intraperitoneal Nutrition Associated with Improved Albumin Levels in Malnourished Patients on Peritoneal Dialysis [PUB413]
J Am Soc Nephrol 35, 2024: Page 1326.

Peritoneal Dialysis Patient with Marked Improvements in Nutritional Markers Despite Foot Wound with Necrosis of Bone While on IPN Therapy

By Araujo, Andrew T., Patient Care America

Background

A 68-year-old medically complex male patient requiring complete assistance with all activities of daily living with ESRD due to diabetes and hypertension, hyperparathyroidism due to renal insufficiency, gastroparesis due to diabetes, cardiomyopathy, peripheral arterial occlusive disease, left below knee amputation, hypoalbuminemia and chronic right foot wound. Patient's albumin three-month average prior to IPN was 2.6 g/dl. Most recent normalized protein nitrogen appearance (nPNA) before IPN therapy was 0.65 g/kg/day. Despite attempts to increase oral intake, patient was unable to consume enough daily amounts of protein / calories needed to meet wound healing needs and Kidney Disease Outcome Quality Initiative (KDOQI) recommendations of serum albumin for maintenance PD patients. IPN therapy was initiated on 2/12/19 per dietitian and nephrologist.

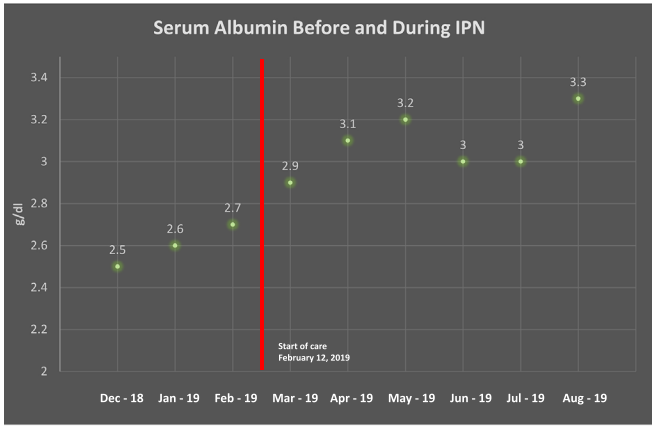
Methods

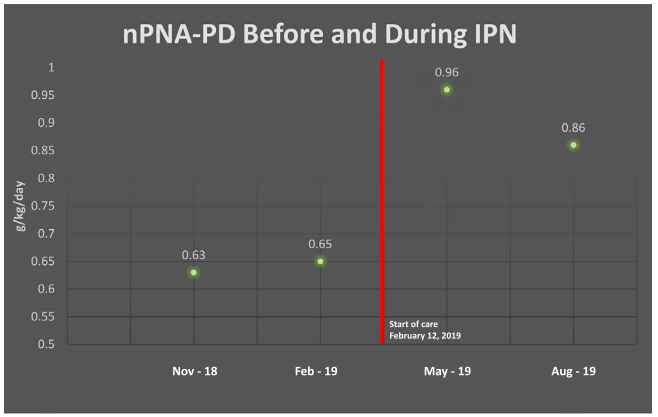
Patient labs / medications were submitted monthly by clinic and monitored routinely by physician and pharmacy, as well as monitoring patient for any signs of intolerance while using IPN. Patients CCPD regimen is Dianeal Low Calcium 1.5% Dextrose, four cycles of 2500 ml fill volume with dwell time of 1 hour 54 minutes. Last fill of 2000 ml with 4-hour dwell. Midday exchange of 2000 ml with 4-hour dwell. Total volume 14 liters: (cycler 12000 ml plus midday 2000 ml). Patient's transport type is Low Average.

Patients CCPD regimen for IPN therapy - IPN recommendation was submitted and approved by nephrologist to replace midday exchange (4 bags per week) with IPN formula Dianeal Low Calcium 1.5% Dextrose with 30 grams of amino acids 20% in a 2000 ml Ultrabag to be administered by caregiver as directed via midday exchange to dwell for 4 hours. At the request of the RD, 30mls of Liquacel oral nutrition supplement was initiated.

Date	Albumin
December 10, 2018	2.5g/dl
January 17, 2019	2.6g/dl
March 11, 2019	2.9g/dl
April 17, 2019	3.1g/dl
May 13, 2019	3.2g/dl
June 7, 2019	3.0g/dl
July 11, 2019	3.0g/dl
August 23, 2019	3.3g/dl

Date	nPNA-PD
November 1, 2018	0.63g/kg/day
February 6, 2019	0.65g/kg/day
May 13, 2019	0.96g/kg/day
August 23, 2019	0.86g/kg/day





Results

After 3 months of IPN, serum albumin increased 19%. After 6 months, serum albumin increased 27% when compared to the 3-month average prior to therapy. Normalized protein nitrogen appearance increased 48% in month 3 and 32% at the end of 6 months. Improved nutritional markers and improved patient energy / well-being are positive outcomes that indicate additional research needs to be done on PD patients with diabetes, chronic wounds and hypoalbuminemia to determine future impact on wound healing.

Conclusions

Patient responded positively to IPN therapy added during a midday exchange 4 times per week. Despite the chronic foot wound with exposed necrotic bone requiring increased need for protein, the patient demonstrated marked improvements in serum albumin and nPNA levels with no reported side effects or complications. In addition, clinic PD RN reports that patient has "made good progress, has more energy and is more alert". Improved nutritional markers and improved patient energy / well-being are positive outcomes that indicate additional research needs to be done on PD patients with diabetes, chronic wounds and hypoalbuminemia to determine future impact on wound healing.

Special thanks to Stephanie Paul, RN, Lori Gabriel, Pharm D, Lara Haddad, RD, Kim Day, Adriana Ball and Markee Murphy that supported, encouraged, guided and contributed to this poster.

Peritoneal Dialysis Patient Experiences Rapid Response to Intraperitoneal Nutrition Resulting in Improved Nutrition and Quality of Life After Several Months of Therapy

By Stephanie Paul, RN, Clinical Support Specialist, Patient Care America

Background

25-year-old Hispanic female with medical history of ESRD, Chronic Glomerulonephritis, Rheumatoid Arthritis/SLE, Lupus Nephritis-class 4b, Lupus Cerebritis, Seizures, Liver Disease, Hypertension, Anemia, Anorexia, Cerebro-Vascular Accident, Proteinuria, Chronic GI issues, Vitamin D deficiency and Paracenteses on an as needed basis. All of the above conditions, along with severe nausea and vomiting, contributed to the patient being unable to meet nutritional needs by mouth. Patient began CAPD December 2017 with a BMI of 16.88 kg/m2 and EDW of 38 kg.

Methods

Patient's initial CAPD prescription was as follows: Four exchanges of 1.5% Dextrose 1500 mL. In January 2018, IPN was initiated replacing the overnight dwell with the addition of 22.5 grams of Prosol in a 1500 mL. Stay Safe bag. During IPN training, the patient was observed to be in bed, weak and lethargic with flat affect, and little appetite. Patient requested changing to CCPD and began training April 2018. The IPN was received during the last fill.

Time of Dialysis	
July 4, 2017	Began hemodialysis
December 5, 2017	Admitted to peritoneal dialysis, CAPD
January 8, 2018	Began IPN therapy
April 27, 2018	Transitioned to CCPD (plus IPN)

Results

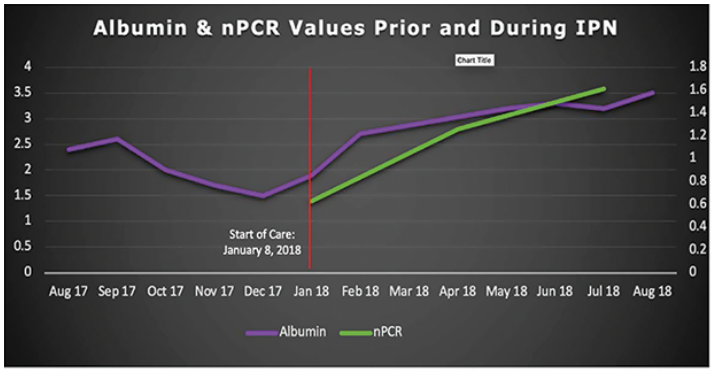
The patient responded well to therapy while being supplemented with IPN, which provided an additional 22.5 gm of protein each day, along with oral nutritional support. During the CCPD re-training visit in May, the patient answered the door smiling, cheerful, and energetic, with visible weight gain. The patient also stated she had been cooking and cleaning. In addition to weigh increase, the patient's labs for serum albumin and nPCR also significantly improved.

Conclusion/Discussion

There were no intolerances reported by the patient throughout the duration of IPN therapy. However, the patient did have one hospitalization in December 2017 for peritonitis (pseudomonas). The patient was treated per clinic policies and procedures. During the course of eight months on IPN therapy, the patient's BMI increased from 13 kg/m2 to 22kg/m2, body weight increased from 32 kg to 53.6 kg, and serum albumin increased from 1.9 gm/dL to 3.5 gm/dL; an improvement of 1.6 gm/dL. Overall protein intake showed dramatic improvement as supported by normal nPCR values.

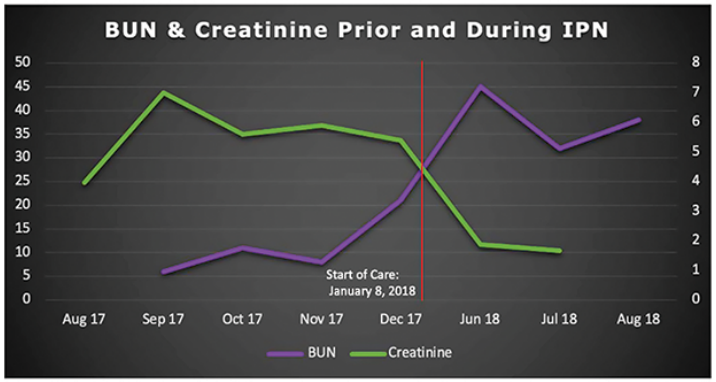
In August 2018, Dr. Cabrera instructed the patient to hold therapy for four weeks to see if the patient could maintain a sufficient oral intake and a healthy nutritional status without supplementation. The patient subsequently regained kidney function and was discharged from PD. Per the nephrologist, the patient attends weekly clinic visits as directed to continue monitoring creatinine/renal status.

Lab values prior and during IPN. Please note major improvement in nPCR, patient's weight and albumin value levels.



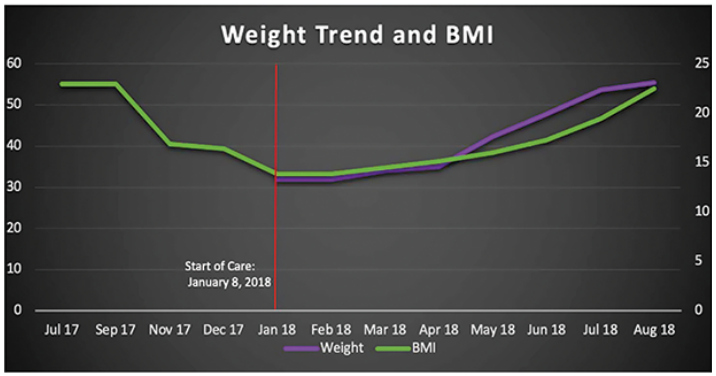
Date	Albumin	Date	Albumin
Aug 2017	2.4 g/dL	Feb 2018	2.7 g/dL
Sept 2017	2.6 g/dL	May 2018	3.2 g/dL
Oct 2017	2 g/dL	Jun 2018	3.3 g/dL
Nov 2017	1.7 g/dL	July 2018	3.2 g/dL
Dec 2017	<1.5 g/dL	Aug 2018	3.5 g/dL
Jan 2018	1.9 g/dL	Labs unavailable: March - April 2018	

Date	nPCR
Jan 2018	0.63 g/kg/day
Apr 2018	1.26 g/kg/day
July 2018	1.61 g/kg/day



Date	BUN	Date	BUN
Sept 2017	6 mg/dL	June 2018	45 mg/dL
Oct 2017	11 mg/dL	July 2018	32 mg/dL
Nov 2017	8 mg/dL	Aug 2018	38 mg/dL
Dec 2017	21 mg/dL	Labs unavailable: Jan-May 2018	

Date	Creatinine	Date	Creatinine
Aug 2017	3.97 mg/dL	Dec 2017	5.4 mg/dL
Sept 2017	7 mg/dL	June 2018	1.88 mg/dL
Oct 2017	5.59 mg/dL	July 2018	1.66 mg/dL
Nov 2017	5.9 mg/dL	Labs unavailable: Jan-May 2018	



Date	Weight	Date	Weight
Jan 2018	32kg	May 2018	42.3kg
Feb 2018	32kg	June 2018	47.8kg
Mar 2018	34kg	July 2018	53.6kg
Apr 2018	35kg	Aug 2018	55.4kg

Date	BMI	Date	BMI
July 2017	22.94 kg/m2	Apr 2018	15.15 kg/m2
Sept 2017	22.94 kg/m2	May 2018	16.01 kg/m2
Nov 2017	16.88 kg/m2	June 2018	17.31 kg/m2
Dec 2017	16.45 kg/m2	July 2018	19.48 kg/m2
Jan 2018	13.85 kg/m2	Aug 2018	22.51 kg/m2
Feb 2018	13.85 kg/m2	Labs unavailable: Aug; Oct 2017 & March 2018	

I'd like to thank Dr. Lisa Cabrera, MD., Cristy Franckowiak, RD., Jaime Alvarez, RN., Tory Olejer, MS, RD., Lori Gabriel, Pharm. D., Adriana Ball, Caroline Eller, Pharm. D., Kim Day, RPh, CP., and Nelson Devesa for your assistance in creating this poster.

Assessment and Outcome of Peritoneal Dialysis Patient Using Two Bags of Intraperitoneal Nutrition (IPN) Leading to Successful Renal Transplant

By Stephanie Paul, RN, Clinic Support Specialist, Patient Care America

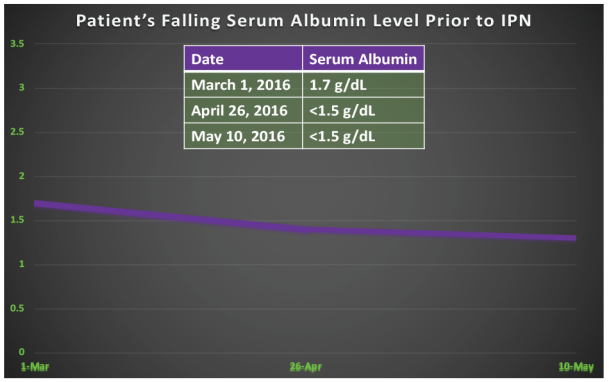
Background

25-year-old Hispanic female with ESRD due to chronic glomerulonephritis and hypertension, hyperparathyroidism due to renal insufficiency, and familial hypophosphatemia. Patient had chronic 1+ lower extremity edema that was difficult to remove. Patient had failed renal transplant at age nine. Patient had began peritoneal dialysis in November 2015.

The patient's inability to consume daily amounts of protein/calories needed to sustain an albumin level to meet KDOQI's recommendation of serum albumin for maintenance of peritoneal dialysis patients led her nephrologist to initiate Intraperitoneal Nutrition (IPN).

Methods

Patient's labs for three consecutive months prior to starting IPN were submitted and reviewed by dietitians and pharmacists.



Patient was CCPD with a prescription of four exchanges, with 2000 mL fill volume, and dwell time of 1 hour 55 minutes. Total treatment time was 8 hours 5 minutes. Patient alternated between CAPD and CCPD depending on her work schedule. Patient was a high average transporter. The intraperitoneal nutrition prescription recommended to the nephrologist was as follows:

Dextrose dialysate equivalence of 1.5% with 30 grams of amino acids in a two liter, low magnesium/low calcium dianeal bag for patient to administer once daily via midday exchange to dwell for five hours. Patient began intraperitoneal nutrition on May 26, 2016. Patient's labs were submitted monthly and patient was contacted weekly by pharmacy staff to ensure no intolerance/ adverse reactions while using IPN. In addition, with

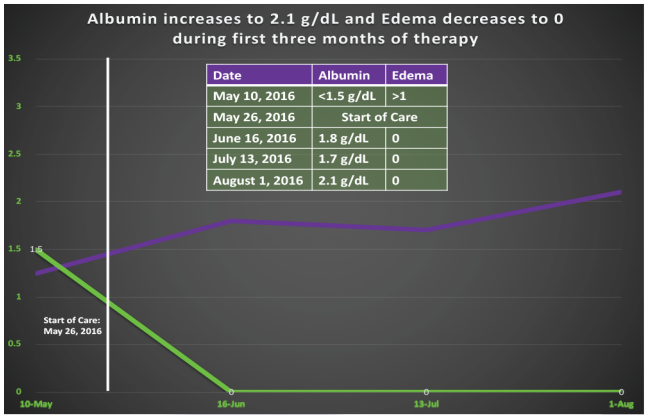
Special thank you to all who helped contribute to this poster including: Dr. Lisa Cabrera, Cristy Franckowiak, RD, Grace Esparza, RN, Martha Lopez RN, Sharon Ptricck, RN, Victoria Olejer, MS, RDN, Lori Gabriel, PharmD, Vishal Bagchi, RD, LD, MBA and Brandy Craig.

Methods (continued)

medication changes from clinic/nephrologist, medication profiles were reviewed for drug interations as needed.

Patient had an immediate response to therapy. On July 27, 2016, patient's nephrologist requested a second bag of intraperitoneal nutrition added to peritoneal dialysis prescription due to the patient's serum albumin upward trend, as well as the patient feeling better with improved fluid removal from lower extremities. In August 2016, RD noted "albumin increased and patient taking in more protein."

"Patient was a part of our Oral Nutrition Support Program and she asked for Nepro every month." RD believes patient used Nepro PRN, but was more consistent at later date. On January 25, 2017, per one of patient's peritoneal dialysis nurses' clinical reports, "patient is doing well and has more energy and better appetite." On May 15, 2017, RD noted that patient stated she was "eating better and remembering Binders."



After three months of receiving intraperitoneal nutrition, albumin presented an upward trend to 2.1 g/dl; a 0.6 g/dl increase! Patient began second bag in August 2016 via manual two liter dextrose dialysis equivalent 1.5% low magnesium/low calcium with 30 grams amino acids added. PD RN noted within 7-8 months of patient initiating IPN the following, "Patient was more active and working part time… Albumin got better…Patient feeling better." PD RN observed albumin labs trend from <1 to 2.5. PD RN noted patient "looked happier and good, especially at the end before receiving transplant", and that patient "was bubbly".

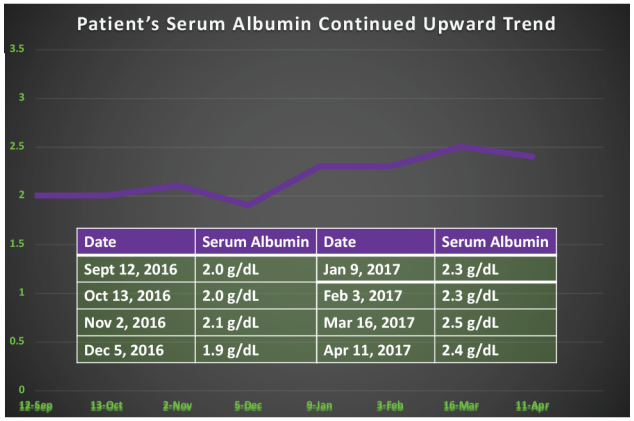
Results

With the incorporation of daily intraperitoneal nutrition as a midday exchange and last fill, there was a positive progression of serum albumin levels trending upwards 2.0 or greater, with the exception of December 2016.

Conclusion/Discussion

Serum Albumin as of:
May 5, 2017 - 2.5 g/dL
June 1, 2017 - 2.3 g/dL
July - No Lab. Patient received transplant before monthly lab was obtained.

Patient incorporated both modalities - APD and CAPD and used intraperitoneal nutrition as midday exchange and last fill via manuals. Patient tolerated intraperitoneal nutrition with no reported side effects or complications. Patient's serum albumin stabilized at ≥ 2.3 g/dL, and patient received a renal transplant in July of 2017.



Benefits of IPN Protein Therapy

- Decreases CRP - Improves Inflammation
- Increases Albumin/Prealbumin - Helps Patient Reach Albumin Goal
- Prevents PEW/Catabolic Effect of Dialysis -Keeps Patient in a Anabolic State
- Reduced Treatment Costs by Keeping Patients Out of the Hospital
- Faster Recovery from Major Surgery such as Limb Amputation including Chemotherapy
- Stable for Transplant - Surgeons Hesitant to Operate with Low Albumin
- Faster Recovery Post-Transplant
- Improved Fluid Balance - Mobility of Extracellular Fluid as Amino Acid Infusion changes Osmotic Pressure Gradients and Albumin Maintains Osmotic Pressure Gradients and Albumin Maintains Osmotic Pressure
- Wound Healing Promoted and Improved Availability of Plasma Proteins
- Improved Strength, Body Composition, and Overall Well-being leading to Higher Quality of Life
- Improved Appetite

PATIENT CARE AMERICA
The Premier Renal Solutions Provider

Evidence-based Benefits Associated with IDPN Treatment

Improvement in albumin, the strongest predictor of hospitalization and morality risk in HD

- **Slusser-Hogan et al (2025)** identified 82% of patients see clinically meaningful improvement in albumin level within 6 months, average improvement was 0.33g/dL.
- **Kittiskulnam et al (2022), Gurlek-Demirci et al (2021), and Thabet et al (2017)** similarly identified statistically significant improvement in albumin compared to control groups.

Reduced hospitalizations

- **Blondin and Ryan (1999)** – 30% reduction in hospitalizations, 40% reduction on duration of hospital stays.
- **Lacson et al (2007)** concludes, "Any nutritional intervention that can improve albumin by 0.2 g/dL (or higher) for patients with severe malnutrition may lead to improved outcomes and appears to be cost-effective."
- **Research presented at NKF Spring Clinicals 2026** identified that patients receiving IDPN may experience a threefold reduction in hospitalizations compared with national averages.

Improvement in lean body mass

- **Gurlek-Demirci et al (2021)** found a significant increase in muscle mass in patient receiving a combination of ONS and IDPN compared to patients receive only IDPN or only ONS or no additional nutrition support.

Increased Appetite

- **Kittiskulnam et al (2022)** found that 3-month treatment with IDPN improved albumin and spontaneous oral intake of protein and calories compared to control group, this was maintained for 3 months after the IDPN was discontinued.

Enhanced antioxidant capacity which can help improve inflammation

- **Eminsoy & Eminsoy (2018)** identified IDPN as a tool for improving antioxidant capacity in HD patients 60 years and older.
- **Thabet et al (2017) and Gurlek-Demirci et al (2021)** identified statistically significant improvements in Malnutrition Inflammation Scores (MIS) in patients receiving IDPN compared to controls.

IDPN has never been implicated in increasing risk of adverse events - including infection and fluid overload

- **Randomized controlled trials including Cano et al (2007), Marsen et al (2017), and Kittiskulnam et al (2022)** identify no statistically significant difference in adverse event reporting between IDPN groups and controls.
- **The VA's Evidence Brief on IDPN (2018)** states, "No differences in adverse events between intervention and control groups were reported, and some of these events may be common in this population due to disease state."

What Does the Research Say About Starting and Stopping IDPN Therapy?

When to initiate IDPN, Carrero et al:

Dietitian Assessment

Assess:

- PO intake and appetite
- GI symptoms
- Weight and physical function

Determine nutrition status → → → → → → →

At Nutrition Risk

Optimize Intake:

- Dietary Counseling
- Improve PO intake
- Trial oral nutrition supplements (ONS)

If intake remains inadequate → → → → →

Mild to Mod Malnutrition

Augment Nutrition:

- ONS + IDPN



If no response or nutrition status worsens → → → → → →

Severe Malnutrition

Advanced Support:

- Enteral nutrition or
- Central parenteral nutrition

Evaluate and regularly access efficacy of interventions

Adapted from Carrero et al, 2022

When to hold IDPN, Sabatino et al

- Stable serum albumin >3.8g/dL for 3 months
- Improvement in SGA score
- Clinical examination of improved nutritional status,
- Increase in oral protein and energy intake to >1.0g/kg/day AND >30kcal/kg/day
- Unresolvable complications or intolerance to IDPN occur

References

1. Slusser-Hogan et al. (2025). Intradialytic Parenteral Nutrition During In-Center Hemodialysis of Patients Leads to Increase in Albumin Without Compromising Safety: Retrospective Analysis. *Kidney360*, 10-34067.
2. Kittiskulnam et al. (2022). The beneficial effects of intradialytic parenteral nutrition in hemodialysis patients with protein energy wasting: a prospective randomized controlled trial. *Scientific Reports*, *12*(1), 1-11.
3. Gurlek Demirci et al. (2021). *Hemodialysis International*, *25*(4), 532-540.
4. Thabet et al. (2017). Could intradialytic nutrition improve refractory anaemia in patients undergoing haemodialysis? *Journal of Renal Care*, *43*(3), 183-191.
5. Blondin & Ryan (1999). Nutritional status: a continuous quality improvement approach. *American Journal of Kidney Diseases*, *33*(1), 198-202.
6. Lacson et al. (2007). Potential impact of nutritional intervention on end-stage renal disease hospitalization, death, and treatment costs. *Journal of Renal Nutrition*, *17*(6), 363-371.
7. Eminsoy & Eminsoy (2018). Effects of intradialyitic parenteral nutrition on antioxidant capacity hemodialysis patients over 60 years. *Clinical Nutrition*, *37*, S162.
8. Cano et al. (2007). Intradialytic Parenteral Nutrition Does Not Improve Survival in Malnourished Hemodialysis Patients: A 2-Year Multicenter, Prospective, Randomized Study. *Journal of the American Society of Nephrology*, *18*(9), 2583-2591.
9. Marsen et al. (2017). Intradialytic parenteral nutrition in maintenance hemodialysis patients suffering from protein-energy wasting. Results of a multicenter, open, prospective, randomized trial. *Clinical Nutrition*, *36*(1), 107-117.
10. Anderson et al. (2018). *Evidence Brief:* Use of Intradialytic Parenteral Nutrition (IDPN) to Treat Malnutrition in Hemodialysis Patients.
11. Carrero et al (2022). Intradialytic parenteral nutrition for patients on hemodialysis: when, how and to whom? *Clin Kidney J. 16*(1):5–18
12. Sabatino et al (2017). Protein-energy wasting and nutritional supplementation in patients with end-stage renal disease on hemodialysis. *Cln Nutr. 36*(3):663-671

Notes

Patient Care America

The Premier Renal Solutions Provider

For more Clinician Resources, scan the code to visit our portal

PCAB ACCREDITED Compounding Pharmacy | ACHC ACCREDITED | NABP Accredited Compounding Pharmacy | HIPAA COMPLIANT | URAC ACCREDITED Specialty Pharmacy

Office: **(866) 348-0441** | Fax: (888) 503-6982 | **pcacorp.com**