Oral Nutritional Supplements in Hemodialysis Patients

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Background

- **Protein-energy malnutrition (PEM) occurs frequently among end-stage renal disease (ESRD) patients undergoing hemodialysis**
  - **PEM is estimated to occur in 50% to 70% of hemodialysis patients**
- **PEM is associated with increased risk of hospitalization and mortality**

Objective

To assess the impact of oral nutritional supplements on mortality, morbidity, and nutrition in hemodialysis patients at a large dialysis organization

Methods: Study Design

- **A pilot program providing ONS to 3,399 patients with serum albumin ≤ 3.5 g/dL**
  - **Launched in 408 LDO facilities**
  - **September 2012 - January 2013**
- **ONS patients**
  - **Received at least 1 dose**
  - **Propensity matched 1:1 to similarly hypoalbuminemic controls who dialyzed at facilities in which ONS was not offered**
- **Followed for death, rates of hospitalization and missed treatment, time-to-albumin recovery, and nutritional markers**

Methods: Matching

- **Propensity score was estimated using a logistic model in which receipt of ONS was the dependent variable and was predicted (as of entry date) on the basis of:**
  - Qualifying albumin level
  - Month of entry
  - Age
  - Sex
  - Race
  - Etiology ESRD
  - Access type
  - Diabetes
  - Charlson score
  - Vintage
  - Body mass index
  - Hospitalization in the prior month
  - Hemoglobin
  - Phosphorus
- **ONS patients were matched 1:1 to controls using a nearest neighbor matching algorithm.**
  - Matching was done separately for HD and PD patients to ensure that matched pairs would be concordant on modalities and thereby enable subgroup analysis by modality
- **All ONS patients were successfully matched to 1 control. Baseline comparison of ONS patients to matched controls is presented in Table 2.**
  - The 2 groups were well balanced on all baseline characteristics

Table: Comparison of Baseline Characteristics between ONS Users and Controls in Matched Cohort

Variable		Control (N=3,399)	ONS (N=3,399)	p (ONS vs Control)
Age, years	Mean ± SD	67.1 ± 13.9	66.7 ± 13.7	0.24
Gender	Female, n(%)	1,636 (48.1%)	1,600 (47.1%)	0.38
Race/Ethnicity	White, n (%)	1,486 (43.7%)	1,517 (44.6%)	0.66
	Black, n (%)	1,059 (31.2%)	1,057 (31.1%)	
	Hispanic, n (%)	507 (14.9%)	507 (14.9%)	
	Other, n (%)	347 (10.2%)	318 (9.4%)	
Etiology End-Stage Renal Disease	Hypertension, n (%)	856 (25.2%)	858 (25.2%)	0.94
	Diabetes Mellitus, n (%)	1,725 (50.8%)	1,712 (50.4%)	
	Other, n (%)	818 (24.1%)	829 (24.4%)	
Access	Arteriovenous fistula, n (%)	1,715 (50.4%)	1,718 (50.5%)	0.98
	Arteriovenous graft, n (%)	549 (16.2%)	559 (16.5%)	
	Central venous catheter, n (%)	1,110 (32.7%)	1,097 (32.3%)	
	Peritoneal dialysis catheter, n (%)	25 (0.7%)	25 (0.7%)	
Diabetes	n (%)	2,440 (71.8%)	2,436 (71.7%)	0.91
Post-dialysis weight, kg	Mean ± SD	76.8 ± 21.8	77.7 ± 22.2	0.08
Body mass index, kg/m^2	Mean ± SD	27.2 ± 7.3	27.2 ± 7.4	0.65
Vintage, month	≤ 3-12, n (%)	1,220 (35.9%)	1,169 (34.4%)	0.70
	12-48, n (%)	1,119 (32.9%)	1,138 (33.5%)	
	>48, n (%)	935 (27.5%)	961 (28.3%)	
	missing, n (%)	125 (3.7%)	131 (3.9%)	
Hospitalization in prior month	n (%)	764 (22.5%)	779 (22.9%)	0.66

Table: Comparison of Baseline Characteristics between ONS Users and Controls in Matched Cohort (Continued)

Variable		Control (N=3,399)	ONS (N=3,399)	p (ONS vs Control)
Charlson Score	2, n (%)	112 (3.3%)	111 (3.2%)	0.90
	3, n (%)	136 (4.0%)	152 (4.5%)	
	4, n (%)	344 (10.1%)	366 (10.8%)	
	5, n (%)	541 (15.9%)	532 (15.7%)	
	6, n (%)	729 (21.5%)	708 (20.8%)	
	7, n (%)	675 (19.9%)	684 (20.1%)	
	8+, n (%)	862 (25.4%)	846 (24.9%)	
Entry date	1-Sept-12, n (%)	311 (9.2%)	303 (8.9%)	0.90
	1-Oct-12, n (%)	1,079 (31.7%)	1,047 (30.8%)	
	1-Nov-12, n (%)	530 (15.6%)	559 (16.5%)	
	1-Dec-12, n (%)	490 (14.2%)	499 (14.7%)	
	1-Jan-12, n (%)	434 (12.8%)	443 (13.0%)	
	1-Feb-12, n (%)	555 (16.3%)	548 (16.2%)	
Hemoglobin, g/dL	≤ 9 -10, n (%)	1,169 (34.4%)	1,165 (34.3%)	0.96
	10-12, n (%)	1,967 (57.9%)	1,961(57.7%)	
	>12, n (%)	246 (7.2%)	257 (7.6%)	
	Missing, n (%)	17 (0.5%)	16 (0.5%)	
Phosphorus, mg/dL	≤ 3.5, n (%)	765 (22.5%)	768 (22.6%)	0.78
	3.5-5.5, n (%)	2,227 (65.5%)	2,211 (65.1%)	
	>5.5, n (%)	372 (10.9%)	391 (11.5%)	
	missing, n (%)	35 (1.0%)	29 (0.9%)	
Qualifying albumin, g/dL	Mean ± SD	3.3 ± 0.3	3.3 ± 0.3	0.96
	Median [p25, p75]	3.4 [3.2, 3.5]	3.3 [3.1, 3.5]	

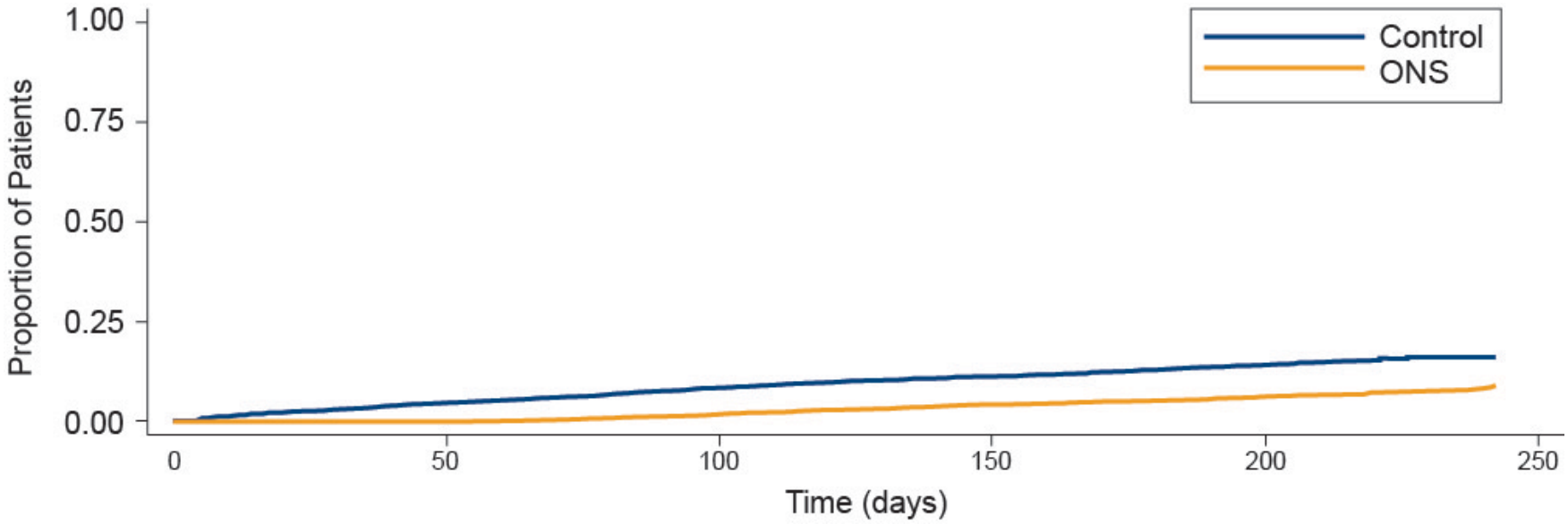
Survival

- **Overall 557 patients died during 2,870 patient-years of at-risk time**
- **Survival was significantly better among ONS patients than matched controls**
- **ONS patients had 69% lower relative risk of death (HR 0.31[0.25-0.39], p<0.001)**

Group	HR (95% CI)	p
Overall		< 0.001
Control	1 (ref)	
ONS	0.31 (0.25-0.39)	
HD only		< 0.001
Control	1 (ref)	
ONS	0.31 (0.25-0.39)	

Abbreviations: CI, confidence interval; HD, hemodialysis; HR, hazard ratio; ONS, oral nutritional supplementation; ref, reference

Cumulative Incidence Curves for Death in ONS Patients versus Matched Controls



Hospitalizations, Missed Treatments, and Albumin Recovery

- **Hospitalization rate was 8% lower among ONS patients**
- **Missed treatment rate was 23% lower among ONS patients**
- **Time-to-albumin recovery (single value ≥4.0 or 2 consecutive months values = 3.9) was slower among ONS patients versus controls**

Nutritional Markers

- **Albumin was lower among ONS patients versus matched controls**
- **nPCR was higher among ONS patients versus matched controls**
- **Post-dialysis weight was higher among ONS patients versus matched controls**
- **Serum creatinine was lower among ONS patients versus matched controls**

Conclusion

- **ONS provided per treatment is associated with markedly and significantly better survival and missed treatment rates, as well as improvements in some nutritional indices**
- **These data argue persuasively for administration of ONS to hypoalbuminemic dialysis patients**