Robert-Bosch-Krankenhaus

Peritonealdialyse - Update 2016

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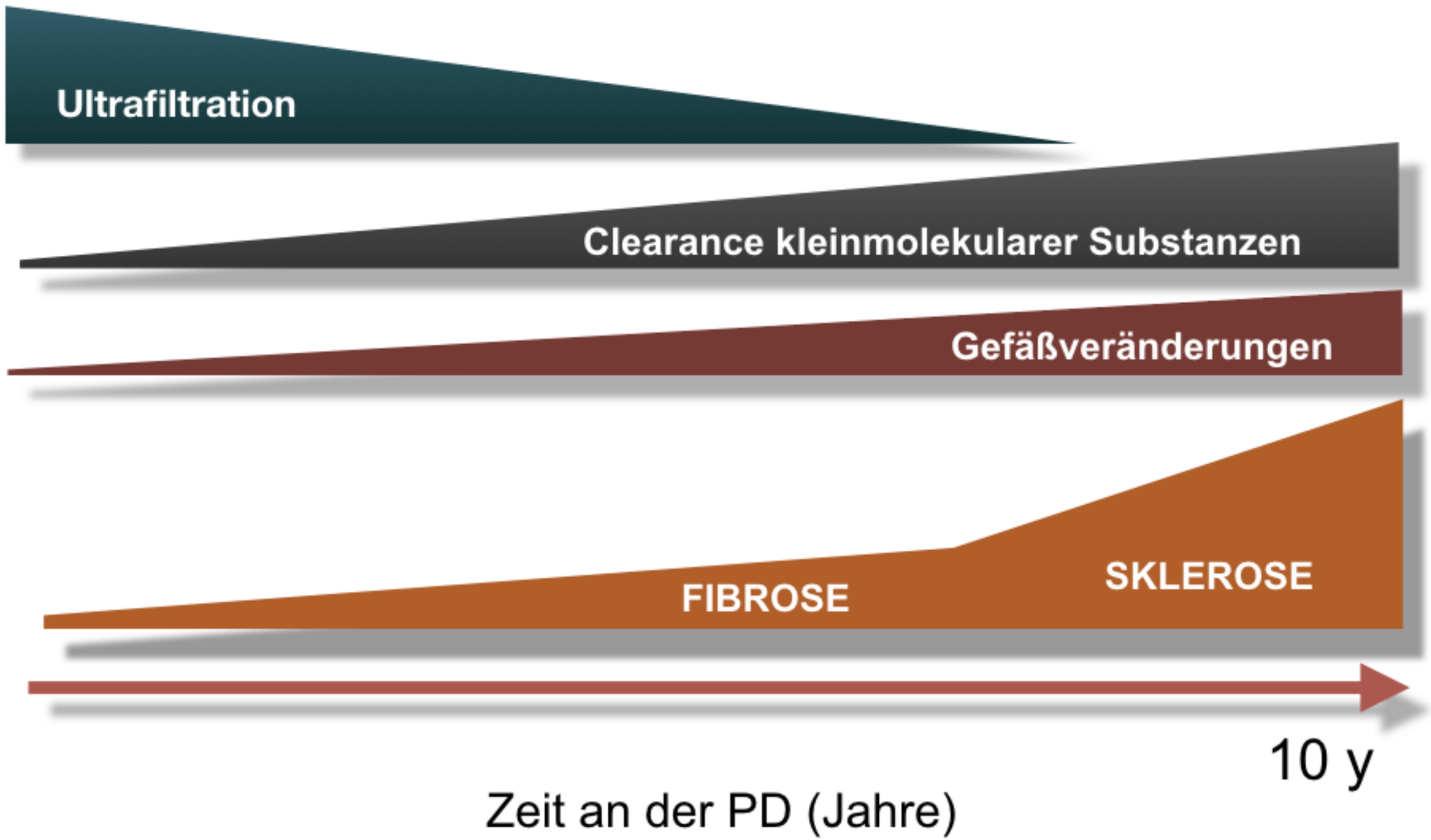
Agenda

Das Update umfasst Neuigkeiten zu den folgenden Punkten:

- Bedeutung Transporteigenschaften / EPS / Aquaporine
- Heim-HD versus PD
- Kochsalz und PD
  - Kochsalzarme Dialysatlösungen
  - Erfahrungen aus China (Kochsalz bei PD)
  - Hyponatriämie und kognitive Funktionen
- Europäische Daten HD / PD

Eigenschaften des Peritoneum während Peritonealdialyse

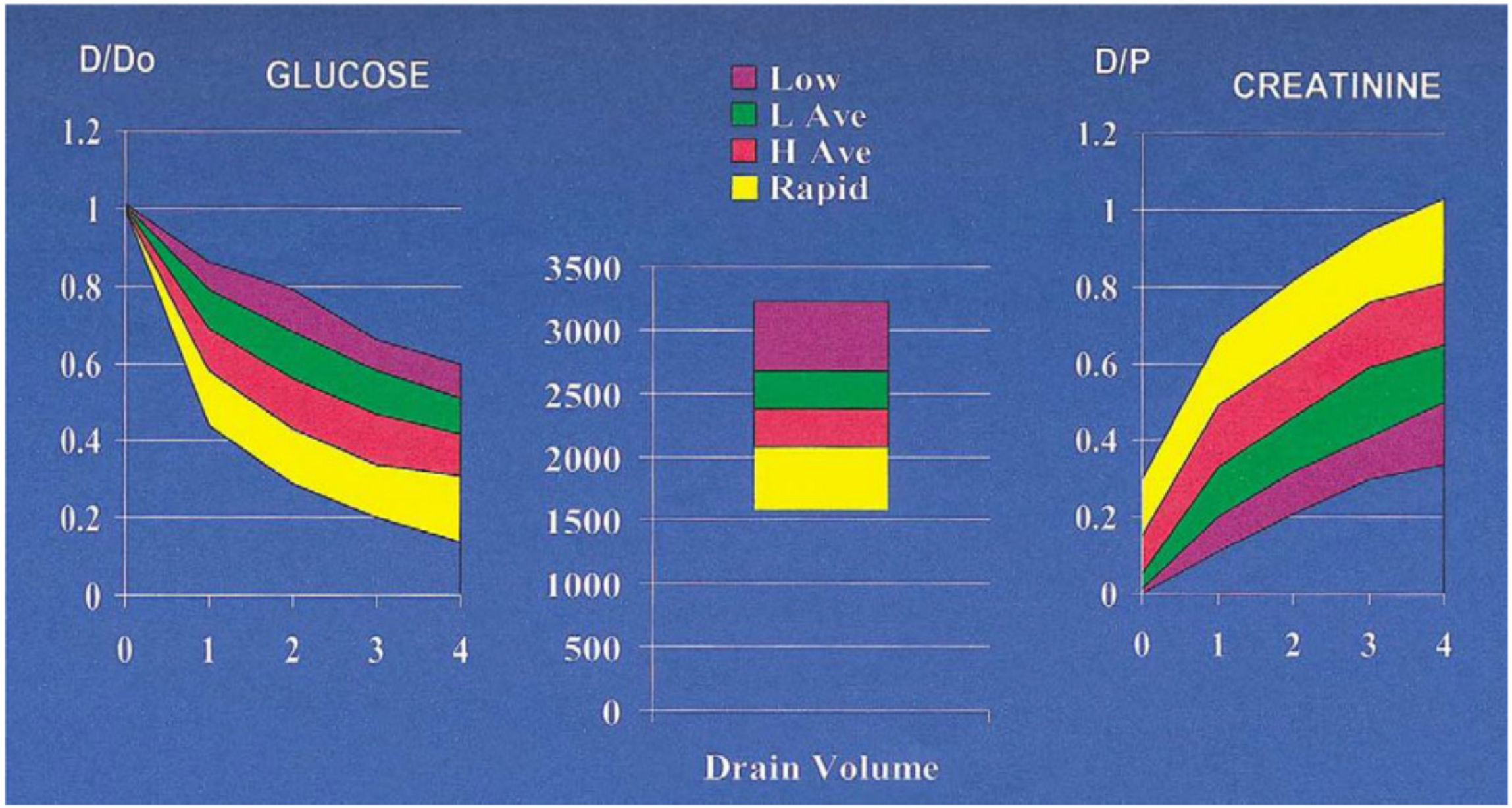


Update on Peritoneal Dialysis: Core Curriculum 2016

In 2006, the International Society of PD (ISPD) published clinical practice guidelines for the adequacy of solute and fluid removal for PD. The general principles in these guidelines continue to steer our therapies. Based on results of clinical studies performed over the last 15 years, delivered weekly clearance should be a minimum Kt/V_{urea} of 1.7, combining peritoneal and kidney clearances.

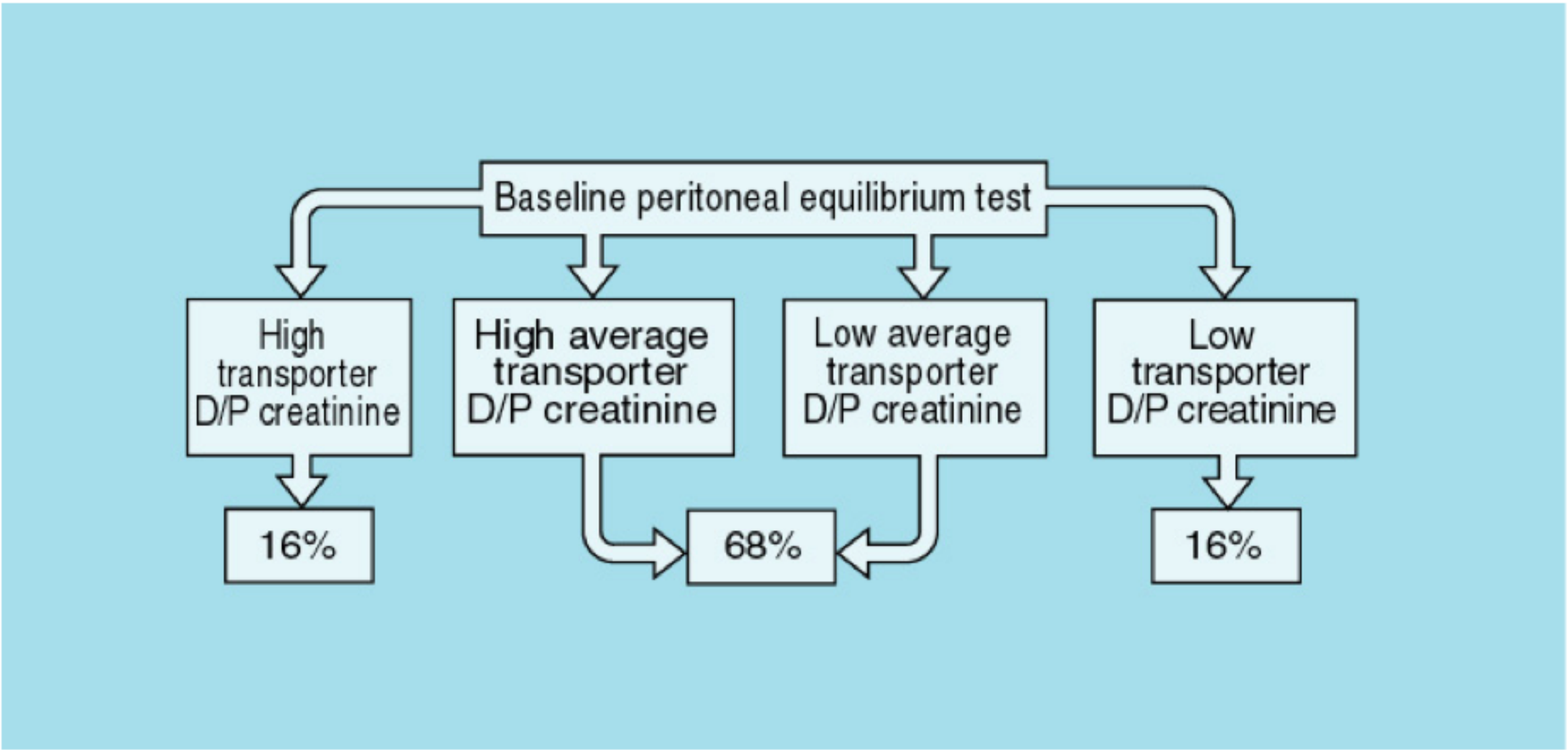
Am J Kidney Dis. 2016;67(1):151-164

Update on Peritoneal Dialysis: Core Curriculum 2016



Am J Kidney Dis. 2016;67(1):151-164

Verteilung der Transportertypen



Ramesh Khanna & Karl D. Nolph

Increased peritoneal permeability at peritoneal dialysis initiation is a potential cardiovascular risk in patients using biocompatible peritoneal dialysis solution

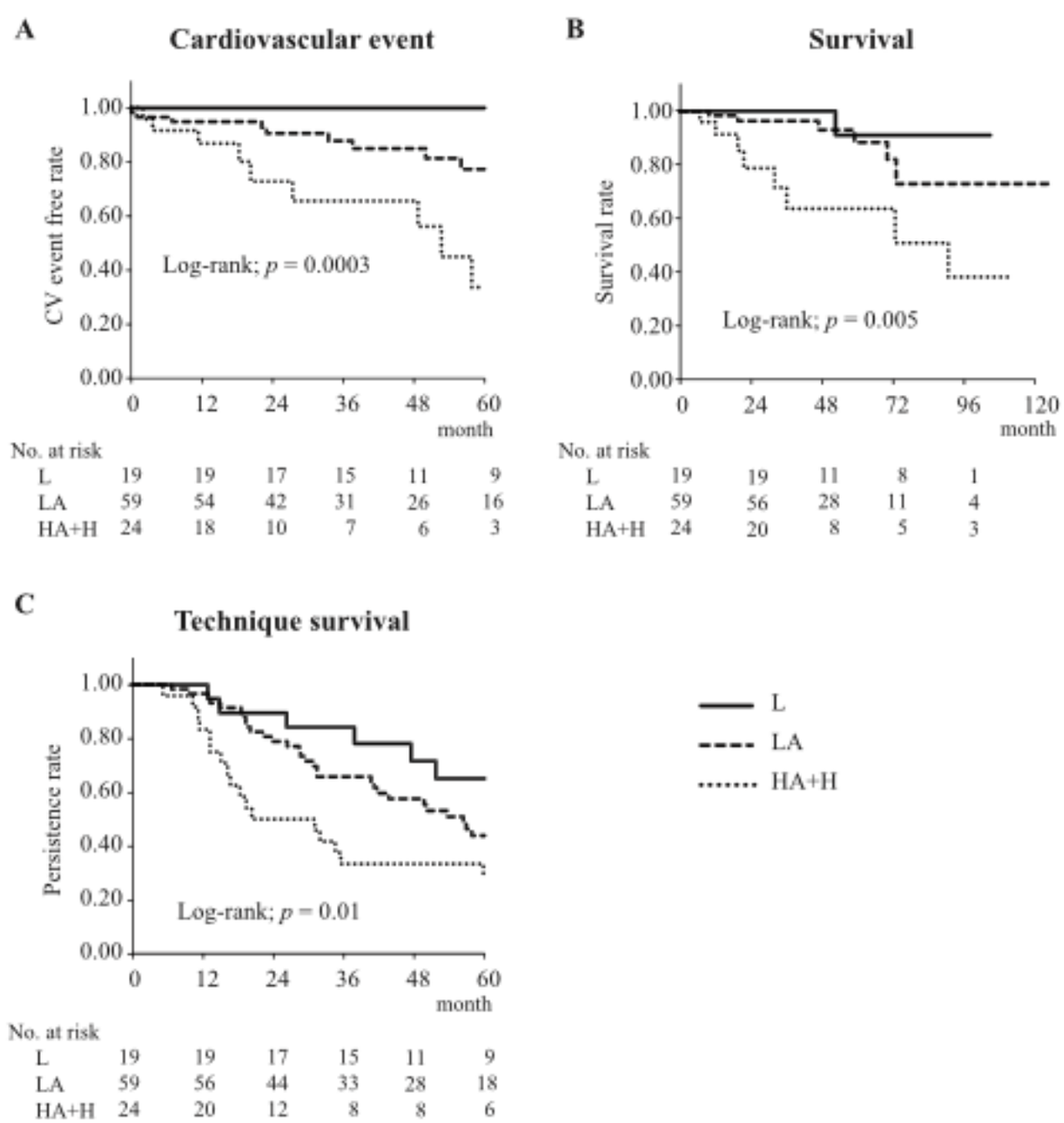
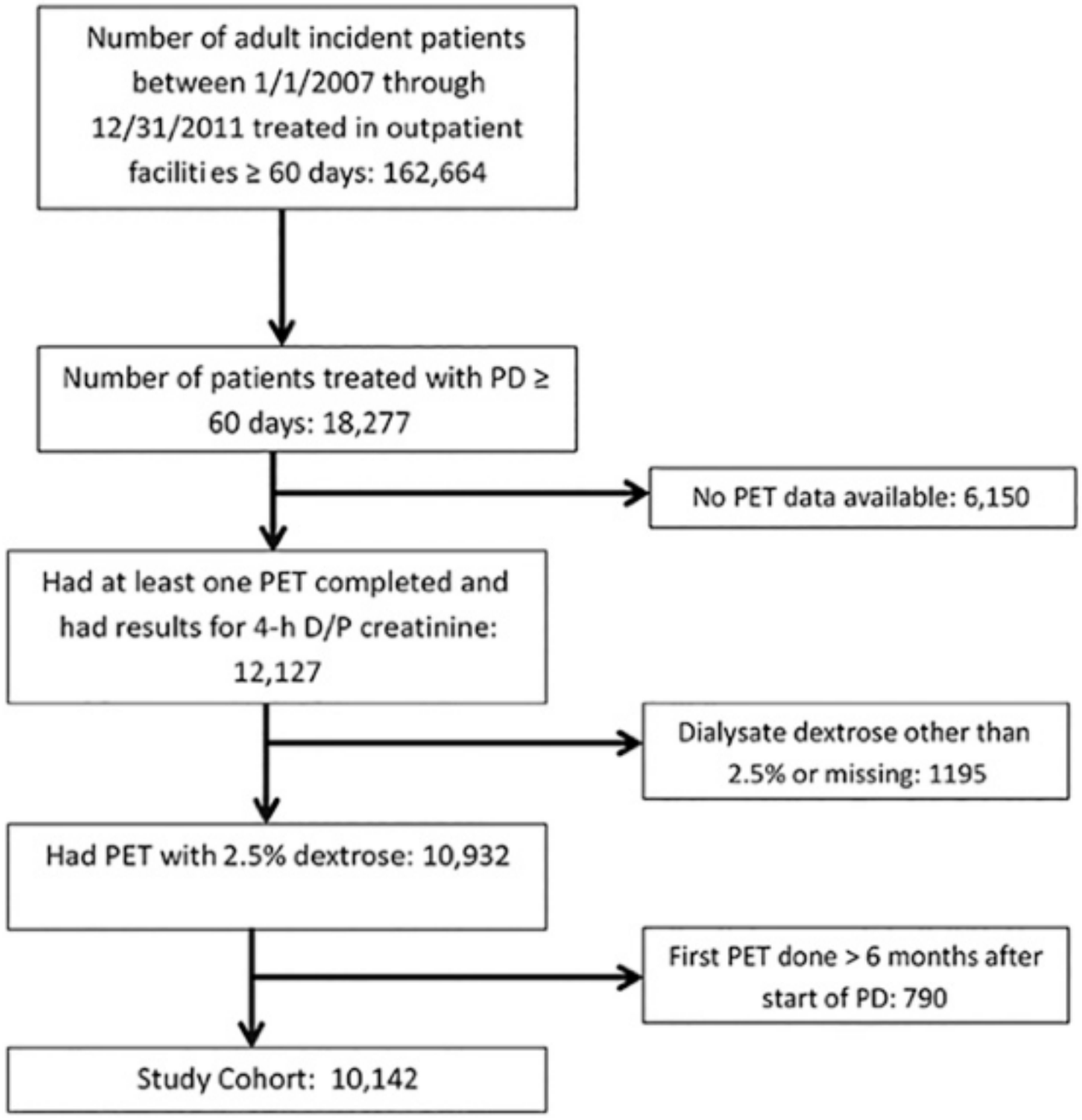


Figure 1 Kaplan–Meier plots of incidence of CV event (A), survival rate (B), and technique survival rate (C) of PD patients using BPDS with neutral pH according to PET category. 102 patients were divided into three groups based on PET category defined by D/Pcre. Patients with D/Pcre <0.50 are in the low (L) group ($n = 19$), $0.50 \leq$ D/Pcre <0.65 are in the low average (LA) group ($n = 59$), and D/Pcre $\geq$0.65 are in the high average and high (HA + H) group ($n = 24$).

BMC Nephrol 2014;15:173

Peritoneal Equilibration Test and Patient Outcomes



CJASN 2015;10:1990

Peritoneal Equilibration Test and Patient Outcomes

Table 1. Patient characteristics stratified by 4-hour dialysate to plasma ratio of creatinine

Variable	Low/Slow (n=1634)	Average (n=6954)	High/Fast (n=1555)	All (n=10,142)
D/P creatinine, mean [range]	0.46±0.05 [0.30–0.52]	0.65±0.07 [0.53–0.77]	0.84±0.05 [0.78–1.13]	0.65±0.12 [0.30–1.13]
Interval from start of PD to PET, d[a]	39 (27–59)	39 (28–61)	41 (28–65)	39 (28–61)
Interval from first dialysis to PET, d[a]	83 (52–159)	98 (57–194)	118 (63–240)	96 (56–188)
D/D0 glucose, mean [range]	0.51±0.06 [0.3–0.98]	0.40±0.07 [0.2–0.92]	0.27±0.06 [0.07–0.6]	0.40±0.09 [0.07–0.98]
4-h Ultrafiltration volume, ml [range]	405±240 [−1400–2000]	285±240 [−1400–2000]	137±257 [−1500–1100]	281±254 [−1500–2000]
Age, yr	54±16	56±15	55±16	56±15
Sex, % men	44	58	66	57
Race, %				
White				58
Black				23
Hispanic				12
Others				7
Cause of ESRD, %				
Diabetes				40
Hypertension				27
Others				33
H/o previous transplant, %				3
H/o prior treatment with hemodialysis, %				39
Comorbidities, %				
Diabetes				63
Hypertension				53
Congestive heart failure				20
Atherosclerotic heart disease				17
Other cardiovascular				15
Dyslipidemia				47
Weekly Kt/V_{urea}[a]				
Peritoneal	1.39 (1.14–1.68)	1.47 (1.23–1.73)	1.51 (1.27–1.78)	1.46 (1.22–1.73)
Residual renal	0.99 (0.54–1.65)	0.86 (0.40–1.41)	0.68 (0.26–1.24	0.86 (0.39–1.43)
Total	2.43 (2.01–3.02)	2.37 (1.90–2.90)	2.27 (1.89–2.79)	2.36 (1.95–2.90)
Residual kidney function, L/wk per 1.73 m^2[b]	76±54	64±49	52±47	64±50
Median weekly ESA dose, units[a]	4474 (1323–10,766)	4830 (1435–11,157)	5280 (1554–11,942)	4864 (1430–11,190)
Laboratory parameters				
Hemoglobin, g/dl	11.8±1.28	11.6±1.3	11.3±1.4	11.6±1.3
Albumin, g/dl	3.8±0.4	3.7±0.4	3.4±0.5	3.6±0.5
Calcium, mg/dl	9.2±0.6	9.1±0.6	9.0±0.7	9.1±0.6
Phosphorus, mg/dl	5.0±1.3	5.0±1.2	5.2±1.3	5.0±1.3
Parathyroid hormone, pg/ml[a]	281 (176–455)	291 (182–463)	315 (192–516)	292 (183–469)
Creatinine, mg/dl	6.5±3.4	7.1±3.6	7.9±3.7	7.2±3.6
Potassium, mEq/L	4.2±0.5	4.2±0.5	4.2±0.5	4.2±0.5
Use of APD, %				
Initial	58	52	48	52
Ever through follow-up	87	88	87	88

Transport-Typ:	low	average	high
Anzahl:	n = 1634	n = 6954	n = 1555
$Kt/V_{peritoneal}$:	1,39	1,47	1,51

CJASN 2015;10:1990

Peritoneal Equilibration Test and Patient Outcomes

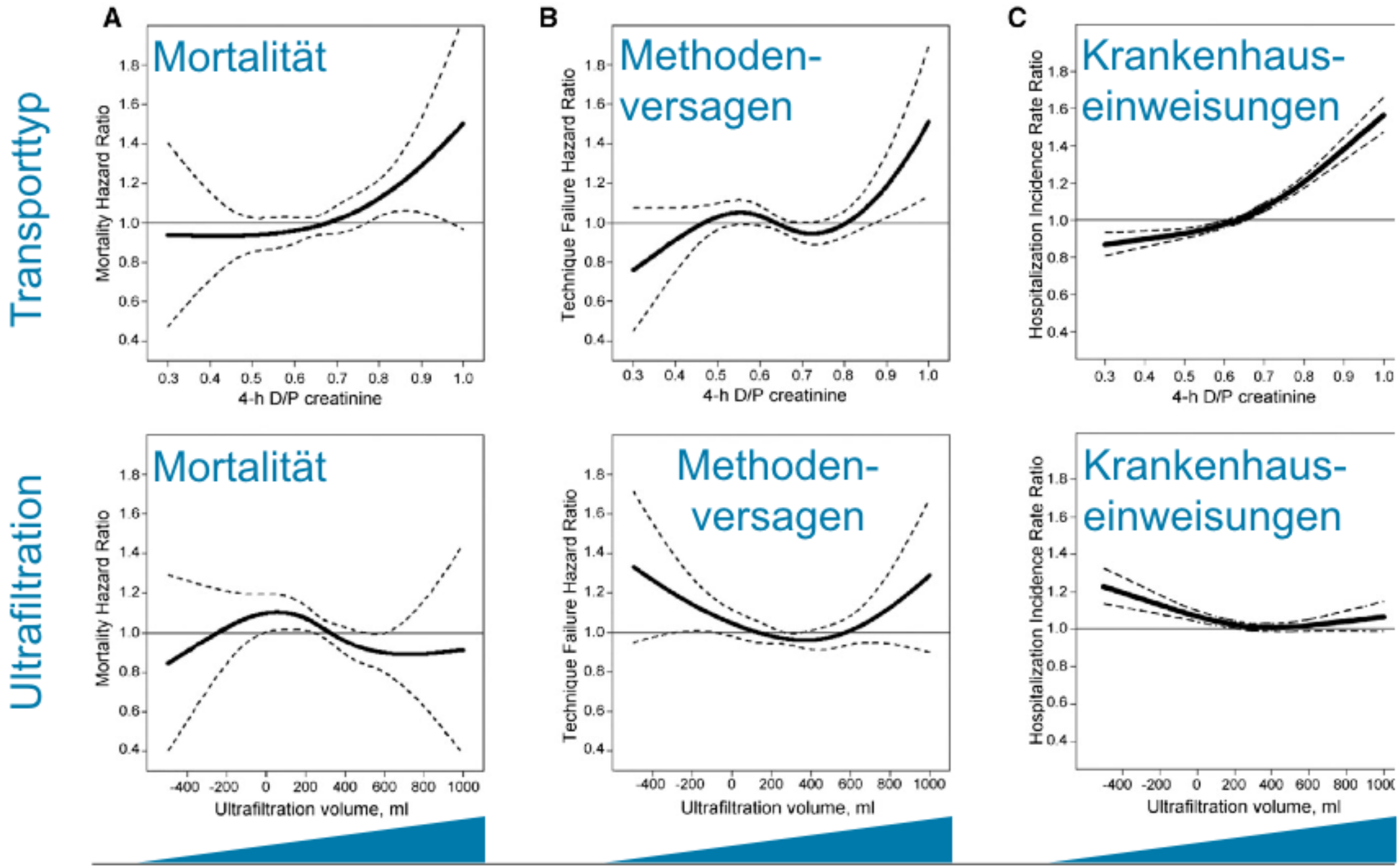


Figure 3. | Association of PET parameters with patient-centered outcomes. Restricted cubic splines illustrating the relationship betwe 4-hour dialysate to plasma ratio of creatinine (D/P creatinine) and ultrafiltration volume from the peritoneal equilibration test and (A) all-cau mortality, (B) technique failure, and (C) hospitalization rate. The bold line reflects the summary effect, and the dotted lines represent 95% confiden intervals.

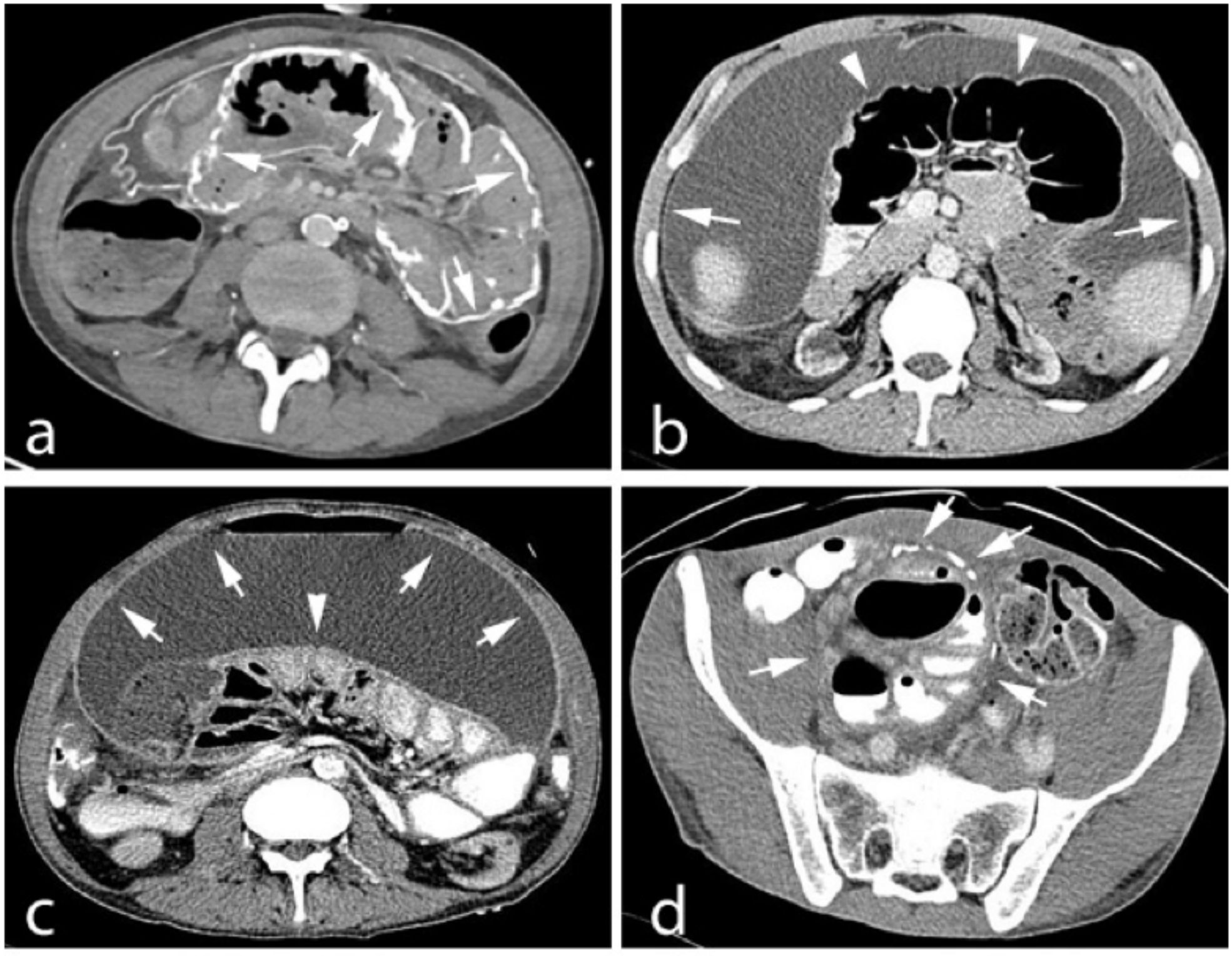
CJASN 2015;10:1990

Peritoneal Equilibration Test and Patient Outcomes

These results make it imperative for us to better understand the biologic basis for interindividual variability and mitigate the change in peritoneal solute transport rate over time. Furthermore, it underscores the continued importance of identifying interventions to improve outcomes in patients on PD with faster peritoneal solute transport rate.

CJASN 2015;10:1990

Verkapselnde Peritonealsklerose (EPS): - Anstieg 4h-D/$P_{Kreatinin}$, dann ∅ UF



EPS-Diagnose:

Trias aus

- Klinik
- Bildgebung
- Pathologie

Interstitial Fibrosis Restricts Osmotic Water Transport in Encapsulating Peritoneal Sclerosis

EPS is a rare but severe complication of peritoneal dialysis (PD) characterized by extensive fibrosis of the peritoneum. Changes in peritoneal water transport may precede EPS, but the mechanisms and potential predictive value of that transport defect are unknown.

Among 234 patients with ESRD who initiated PD at our institution over a 20-year period, 7 subsequently developed EPS.

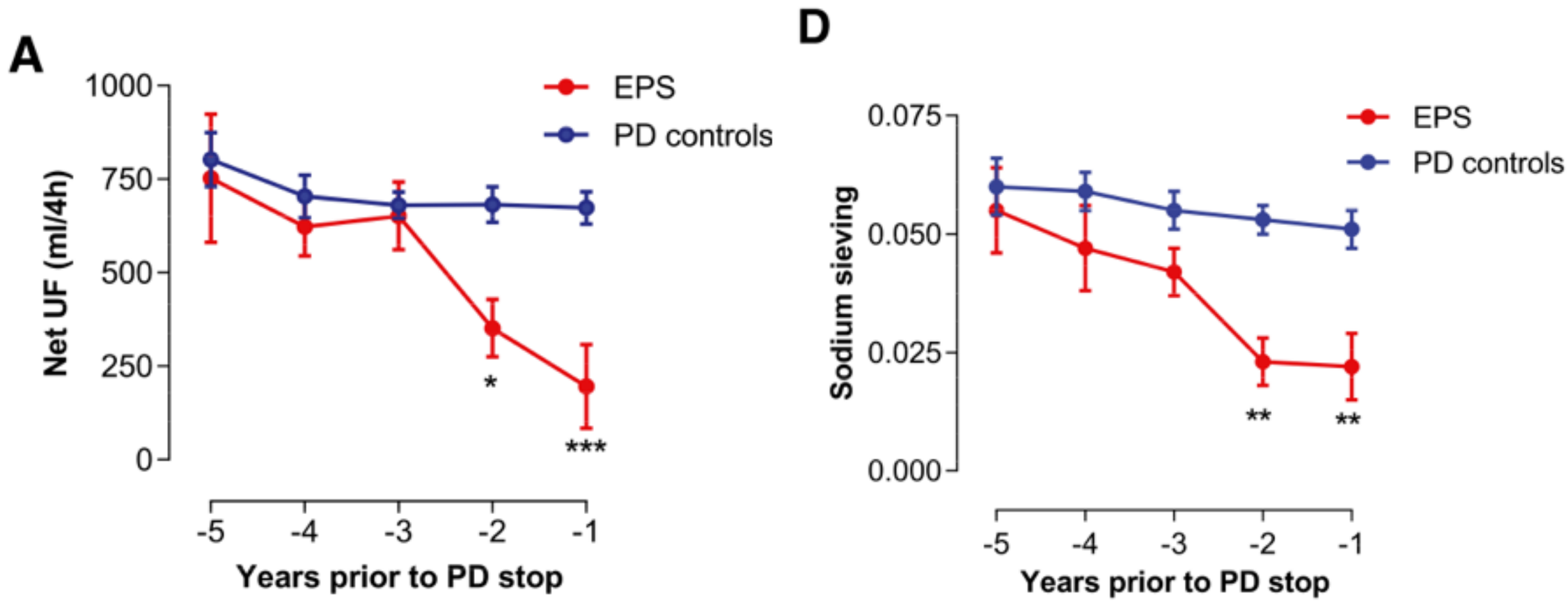
We evaluated changes in peritoneal transport over time on PD in these 7 patients and in 28 matched controls using 3.86% glucose peritoneal equilibration tests.

JASN 2015:26:2521

Interstitial Fibrosis Restricts Osmotic Water Transport in Encapsulating Peritoneal Sclerosis

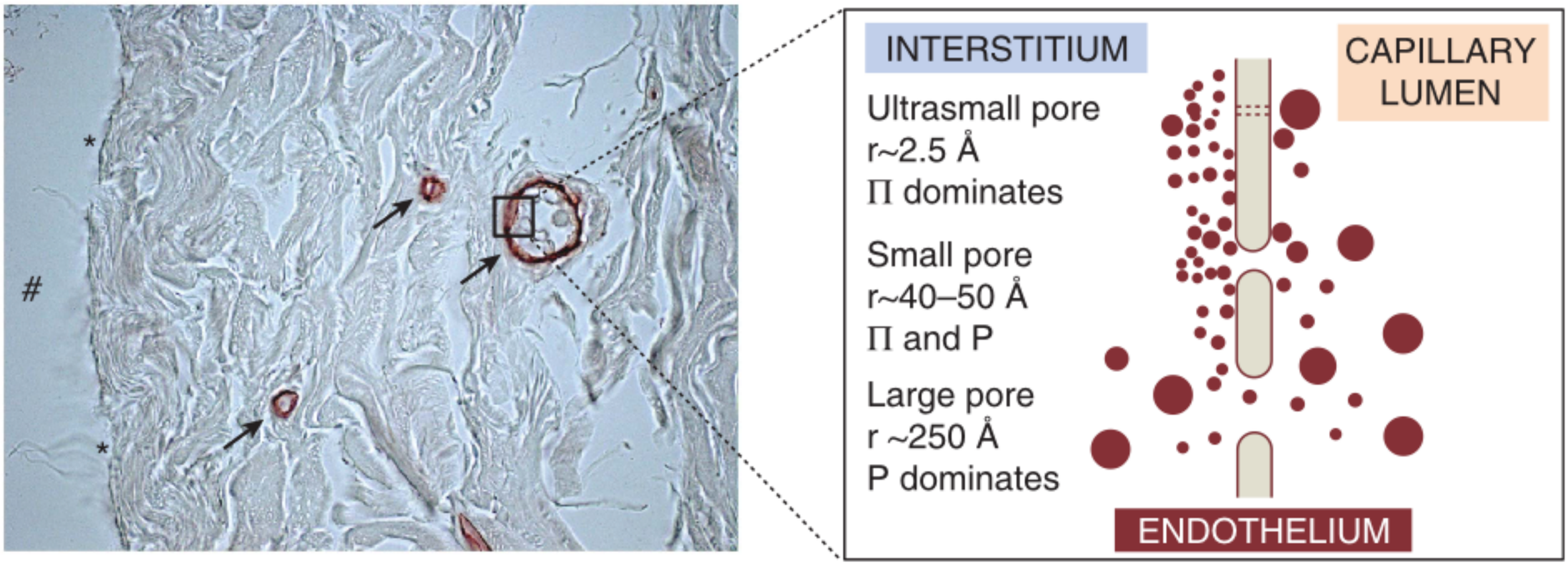
Age at PD Onset (yr)	Sex	Renal Disease	PD Duration (mo)	RRT after PD	Time from PD Withdrawal to EPS (mo)	Recurrent Bowel Occlusion	Symptoms at Diagnosis	CT Diagnosis	Surgical Diagnosis	Outcome after EPS	Time from EPS Diagnosis to Death (mo)	Cause of Death
52	M	MPGN	102	TP	1.8	+	FNVP	+	+	Death	82	Bowel occlusion
57	M	Diabetic	60	HD (UFF)	25.0	+	FNVP, bloody ascites	+	NA	Death	6.6	Septic shock (peripheral arteritis)
39	M	Renal dysplasia	59	HD (UFF)	2.8	+	FNVP bloody ascites	+	+	Death	36.4	Septic shock (endocarditis)
62	M	Vascular	55	TP	2.5	+	FNVP	+	+	Alive, functioning transplant	NA	NA
34	F	Undetermined	39	HD (UFF and EPS)	0.0	+	NVP	+	+	Death	23.5	Bowel perforation
45	F	GN	34	HD (umbilical hernia)	49.6	+	NVP	+	+	Death	3.0	Undetermined
42	M	Undetermined	57	TP (UFF and EPS)	−2.8	+	NVP	+	NA	Alive, functioning transplant	NA	NA

Interstitial Fibrosis Restricts Osmotic Water Transport in Encapsulating Peritoneal Sclerosis



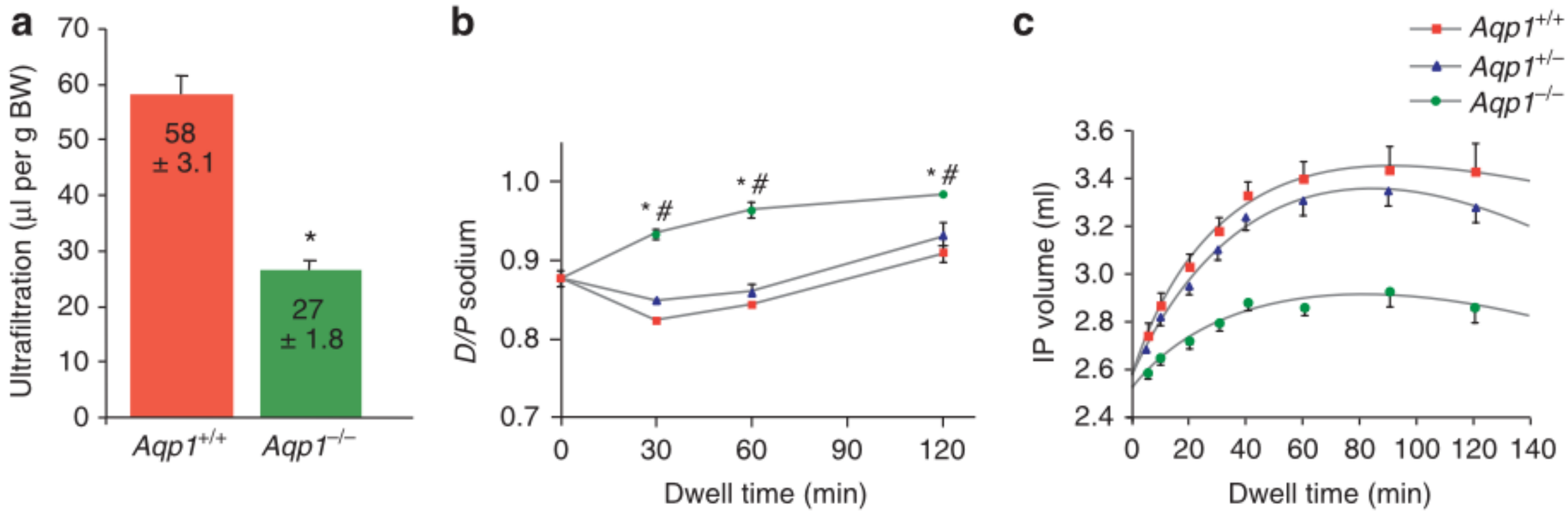
JASN 2015:26:2521

Water transport across the peritoneal membrane



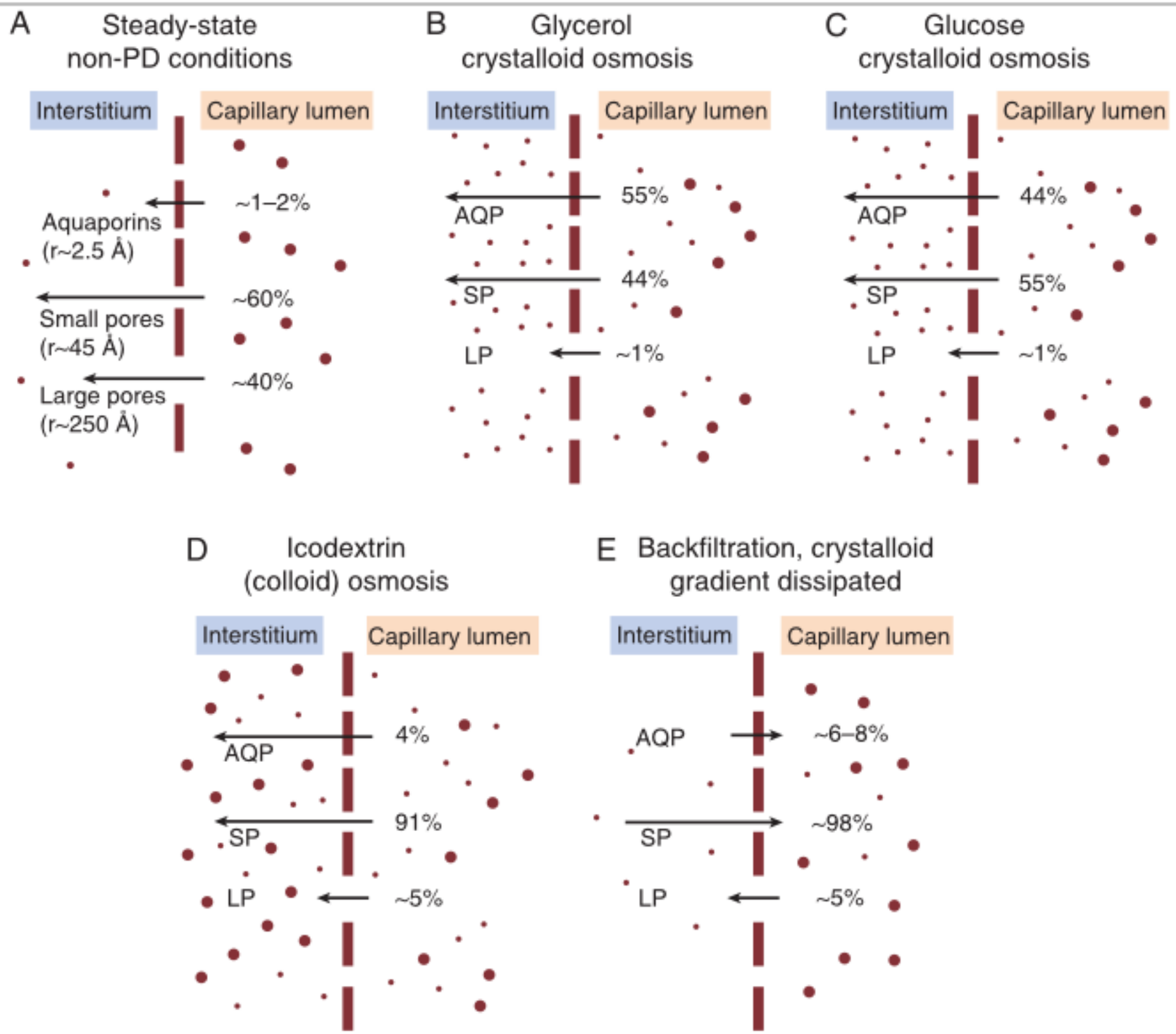
KI 2014;85:750–758

Water transport across the peritoneal membrane



KI 2014;85:750–758

Water transport across the peritoneal membrane



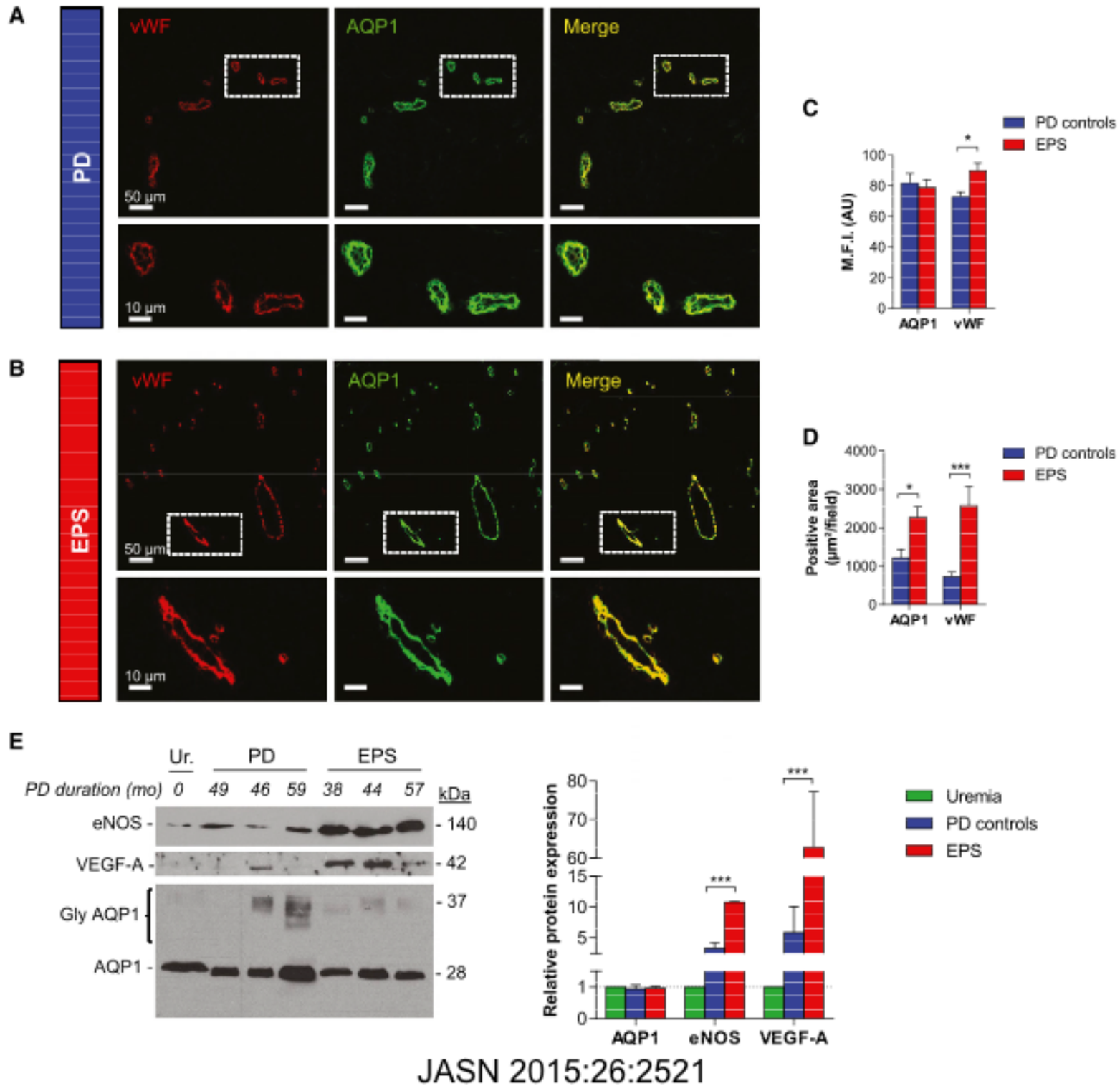
KI 2014;85:750–758

Table 4. Relationship between parameters of peritoneal transport and structural changes in the peritoneum of uremic, long-term PD, and EPS patients

Parameter	Pearson Coefficient (*r*)	*P* Value
Submesothelial thickness versus		
Net UF	−0.68	0.003
Sodium sieving	−0.71	0.003
D/P creatinine 240 min	0.47	0.06
Collagen volume fraction in the submesothelial area versus		
Net UF	−0.56	0.03
Sodium sieving	−0.53	0.03
D/P creatinine 240 min	0.41	0.11

D/P, dialysate-over-plasma.

Interstitial Fibrosis Restricts Osmotic Water Transport in Encapsulating Peritoneal Sclerosis



JASN 2015:26:2521

Ultrafiltration Failure in Peritoneal Dialysis: A Pathophysiologic Approach

High Effective Peritoneal Surface Area (Type 1):

This most common form of ultrafiltration failure arises as a consequence of changes in the peritoneal membrane over time causing a transition to a very rapid transport status. This results in the rapid dissipation of the osmotic gradient and consequently poor ultrafiltration. Clinically, the hallmark of this disorder is the new finding of a D/P creatinine ratio >0.81.

Low Osmotic Conductance to Glucose (Type 2):

The transcapillary movement of free water via aquaporin 1 accounts for 40 to 50% of total ultrafiltration across the peritoneal membrane. In the second type of ultrafiltration failure, decreased osmotic conductance in response to glucose leads to inadequate water removal via aquaporins. The clinical hallmark of this form of ultrafiltration failure is attenuation of sodium sieving, that is, dampening of the decrease in dialysate sodium during the first hour of a dwell with 3.86% glucose.

Low Effective Peritoneal Surface Area (Type 3):

In this rare form of ultrafiltration failure, diffuse hypopermeability of the peritoneal membrane results in impairment of both solute transport and ultrafiltration. Clinically, these patients may therefore present with signs of volume overload, symptoms of inadequate solute removal, or both. The diffuse hypopermeability of the peritoneal membrane appears to be caused by the effects of pro-fibrotic mediators. (EPS)

High Total Peritoneal Fluid Loss Rate (Type 4):

This form of ultrafiltration failure is due to an increase in the rate of bulk fluid absorption from the peritoneal cavity into lymphatics and into the local tissues.

Blood Purif 2015;39:70–73

Agenda

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- Heim-HD versus PD
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Mortality, Hospitalization, and Technique Failure in Daily Home Hemodialysis and Matched Peritoneal Dialysis Patients: A Matched Cohort Study

4,201 neue Heim-HD Patienten wurden mit 4,201 neuen PD Patienten verglichen (adjustiert)

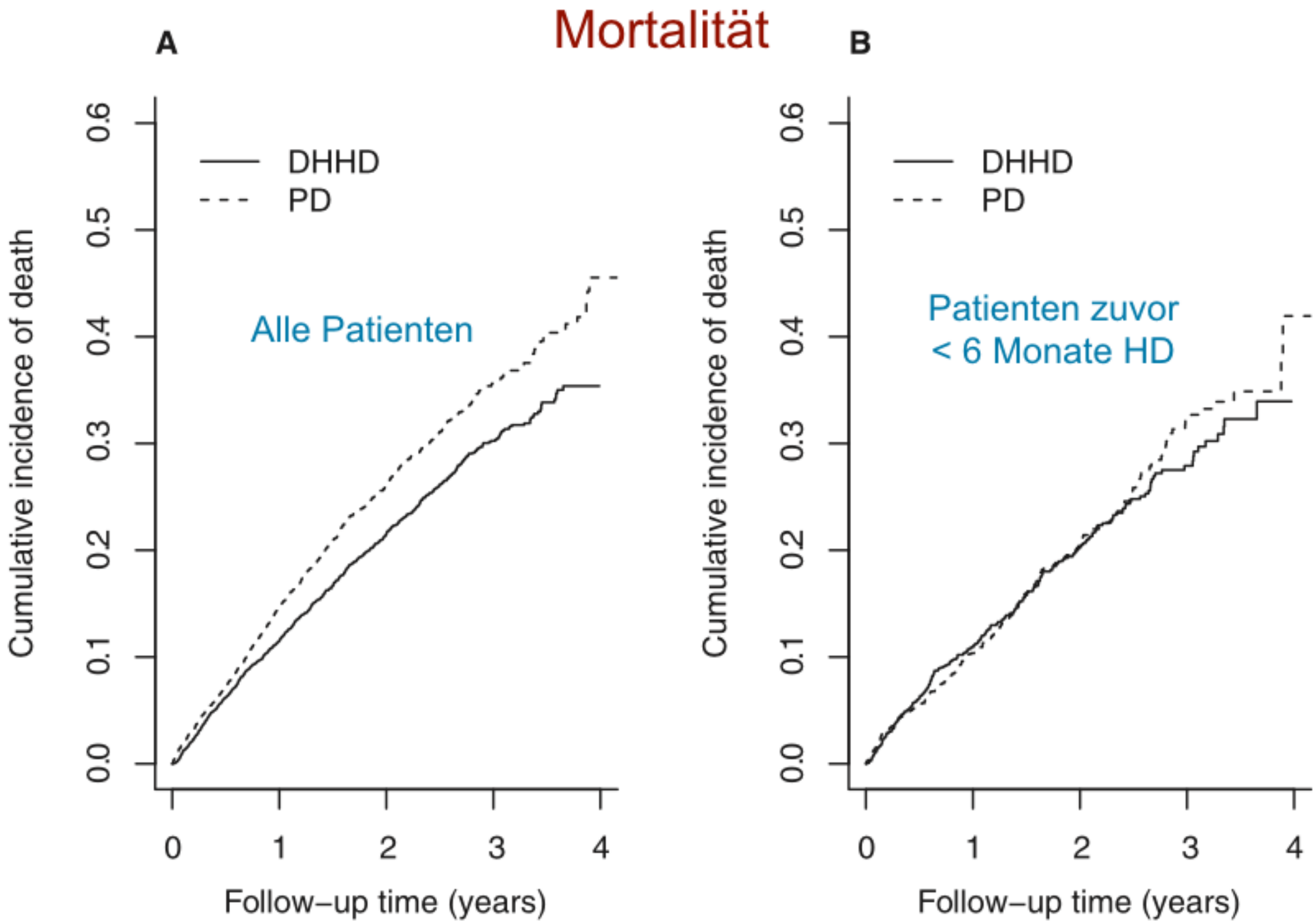
Zeitraum: 2007 bis 2010

Quelle: „US Renal Data System database“.

Endpunkte: Relative Mortalität, Hospitalisierungen, Methodenüberleben.

AJKD 2016;67(1):98-110

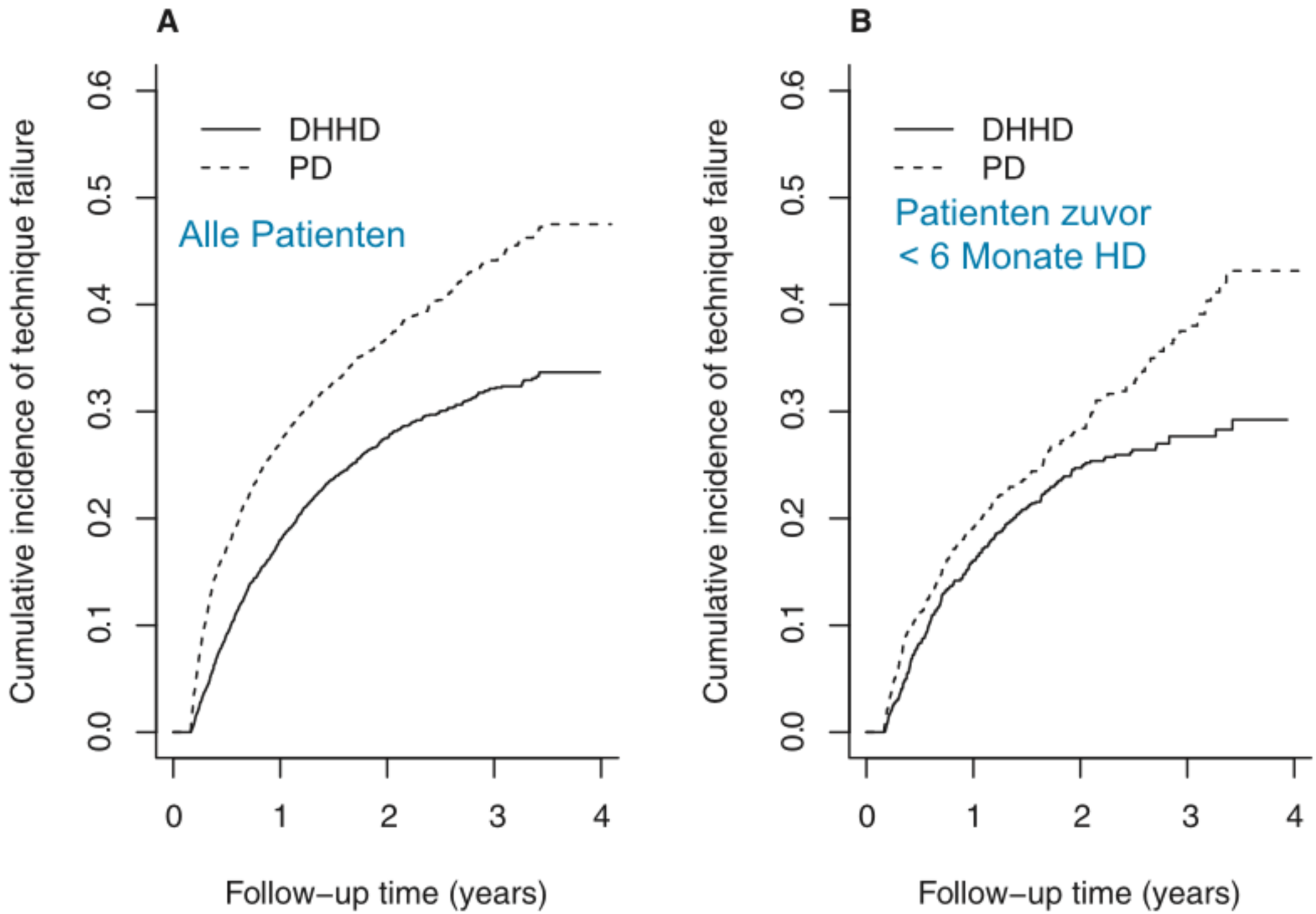
Mortality, Hospitalization, and Technique Failure in Daily Home Hemodialysis and Matched Peritoneal Dialysis Patients: A Matched Cohort Study



AJKD 2016;67(1):98-110

Mortality, Hospitalization, and Technique Failure in Daily Home Hemodialysis and Matched Peritoneal Dialysis Patients: A Matched Cohort Study

Methodenversagen



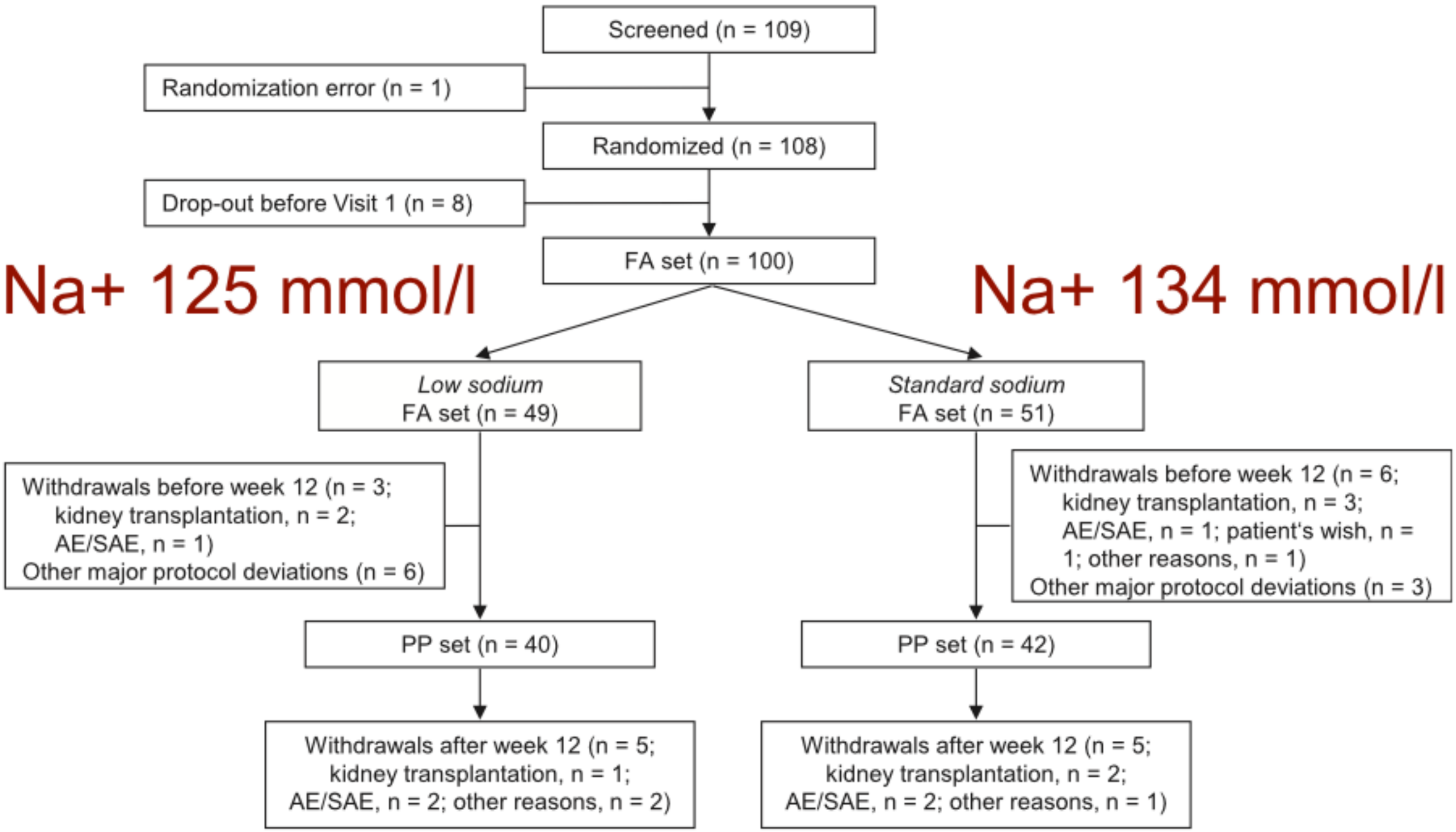
AJKD 2016;67(1):98-110

Mortality, Hospitalization, and Technique Failure in Daily Home Hemodialysis and Matched Peritoneal Dialysis Patients: A Matched Cohort Study

In conclusion, we found that daily HHD patients had significantly lower risks for mortality, hospitalization, and technique failure than matched PD patients. However, in the subset of patients who initiated home dialysis therapy shortly after ESRD onset, we found that risks for mortality and hospitalization were similar for daily HHD patients and PD patients. Further studies are needed to replicate findings, particularly among incident patients with ESRD who begin on home dialysis therapy. Meanwhile, daily HHD may be a viable first modality for patients who choose to dialyze at home and may keep patients at home longer than PD does.

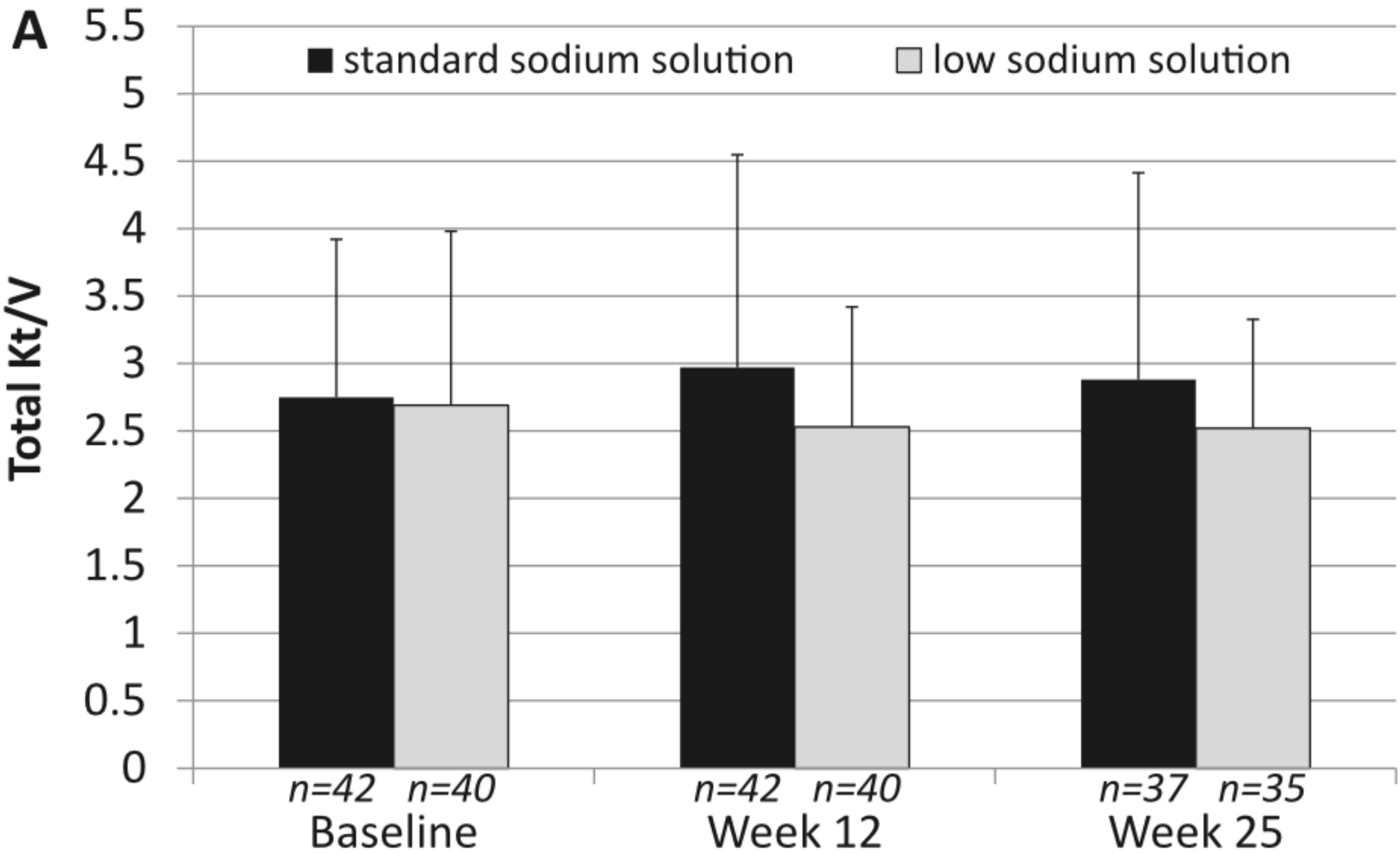
AJKD 2016;67(1):98-110

Low-Sodium Versus Standard-Sodium Peritoneal Dialysis Solution in Hypertensive Patients: A Randomized Controlled Trial



AJKD 2015; online 15.9.

Low-Sodium Versus Standard-Sodium Peritoneal Dialysis Solution in Hypertensive Patients: A Randomized Controlled Trial



AJKD 2015;online 15.9.

Low-Sodium Versus Standard-Sodium Peritoneal Dialysis Solution in Hypertensive Patients: A Randomized Controlled Trial

	Low-Sodium Solution			Standard-Sodium Solution		
	Baseline	Wk 12	Wk 25	Baseline	Wk 12	Wk 25
Sodium removal urine, g/d	1.86 ± 1.35	1.79 ± 1.96	1.99 ± 1.88	2.22 ± 3.50	2.04 ± 2.10	2.09 ± 2.38
Sodium removal dialysate, g/d	3.10 ± 1.92	2.71 ± 2.13	2.67 ± 1.66	1.68 ± 1.65	1.75 ± 2.05	1.32 ± 2.02
Serum sodium, mEq/L	140.2 ± 3.03	137.8 ± 3.59	138.3 ± 3.95	139.6 ± 3.53	139.4 ± 2.83	138.4 ± 3.30

Kochsalzentfernung Gesamt (Urin + PD):

4.96 4.50 4.66	3.90 3.79 3.41
Na^+ = 125 mmol/l	Na^+ = 134 mmol/l

AJKD 2015; online 15.9.

Low-Sodium Versus Standard-Sodium Peritoneal Dialysis Solution in Hypertensive Patients: A Randomized Controlled Trial

In conclusion, a PD solution with a reduced sodium content of 125 mmol/L was investigated for its ability to provide adequate dialysis and to improve BP control in PD patients. Although results of the study **did not show statistical proof of noninferiority** for the primary efficacy parameter total Kt/V due to urea variability of residual kidney function, noninferiority was demonstrated for patients with GFRs < 6 mL/ min/1.73 m^2 and for peritoneal clearances. With respect to sodium removal and BP control, a significant improvement could be seen with the low-sodium PD solution. Evaluation of safety parameters revealed that treatment with the new solution was safe and well tolerated. **Low-sodium PD solutions may be a viable alternative to standard solutions for hypertensive longterm PD patients.**

AJKD 2015; online 15.9.

Time-dependent associations between total sodium removal and mortality in patients on PD

UF ⬆ + entfernte Natriummenge ⬆ ≈ Mortalität ⬇

Jager KJ, Merkus MP, Dekker FW, Boeschoten EW, Tijssen JG, Stevens P, et al. Mortality and technique failure in patients starting chronic peritoneal dialysis: results of The Netherlands Cooperative Study on the Adequacy of Dialysis. NECOSAD Study Group. Kidney Int 1999; 55:1476–85.

Brown EA, Davies SJ, Rutherford P, Meeus F, Borras M, Riegel W, et al. Survival of functionally anuric patients on automated peritoneal dialysis: the European APD Outcome Study. J Am Soc Nephrol 2003; 14:2948–57.

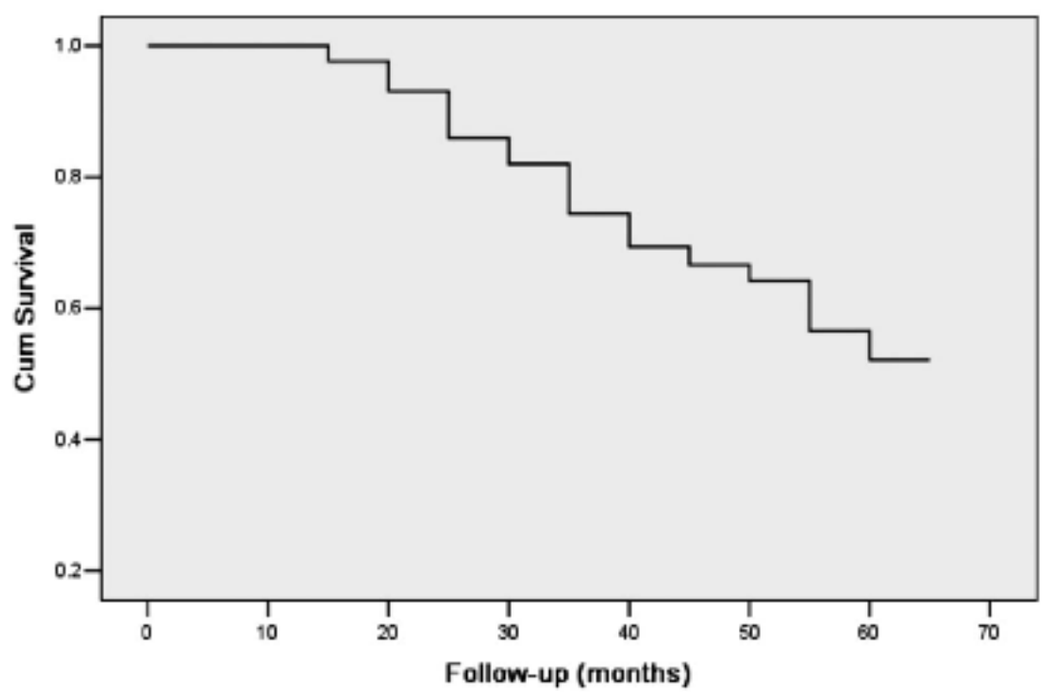
Ates K, Nergizoglu G, Keven K, Sen A, Kutlay S, Erturk S,et al. Effect of fluid and sodium removal on mortality in peritoneal dialysis patients. Kidney Int 2001; 60:767–76.

Wiggins KJ, Rumpsfeld M, Hawley CM, O'Shea A, Isbel NM, Campbell SB, et al. Baseline and time-averaged fluid removal affect technique survival in peritoneal dialysis in a non-linear fashion. Nephrology (Carlton) 2007; 12:218–23.

Time-dependent associations between total sodium removal and mortality in patients on PD

Variable	Overall	Time-averaged total Na removal Low < 2.67g/d < High		*p* Value
Patients (*n*)	305	152	153	—
Age (years)	59.4±14.2	59.9±14.6	58.9±13.7	0.54
Sex [*n* (%) men]	129 (42.3)	53 (34.8)	76 (49.6)	0.01
Body mass index (kg/m^2)	23.4±3.8	22.6±3.4	24.2±4.0	<0.001
Charlson comorbidity index	5 (3–8)	5 (3–8)	5 (3–8)	0.79
Diabetes [*n* (%)]	123 (40.3)	59 (38.8)	66 (41.8)	0.64

[a] Mean ± standard deviation, median (25th–75th percentile), or absolute number and percentage. The cut-off point for time-averaged total sodium removal was 2.67 mmol/L.



PDI 2011;31(4):412-421

Time-dependent associations between total sodium removal and mortality in patients on PD

Variable	Time-averaged total Na removal[a] Low < 2.67g/d <	High	*p* Value
Patients (*n*)	152	153	—
Dialysate glucose concentration (%)	1.69±0.26	1.71±0.27	0.84
Infused dialysate (mL)	5596±1755	6007±1594	0.03
Drained dialysate (mL)	6015±1919	6648±1834	0.003
Daily ultrafiltration (mL)	475 (209–712)	621 (269–890)	<0.001
Daily urine output (mL)	466 (213–772)	703 (352–1030)	<0.001
Daily total fluid removal (mL)	991 (832–1152)	1303 (1133–1496)	<0.001
Daily renal Na removal (g)	0.72 (0.34–1.33)	1.43 (0.67–2.30)	<0.001
Daily peritoneal Na removal (g)	0.96 (0.41–1.53)	1.99 (0.97–2.75)	<0.001
Daily total Na removal (g)	2.01 (1.48–2.36)	3.46 (2.99–4.05)	<0.001
Weekly renal Kt/V	0.34 (0.18–0.66)	0.54 (0.27–0.93)	0.003
Weekly peritoneal Kt/V	1.26 (1.03–1.50)	1.31 (0.98–1.53)	0.21
Weekly total Kt/V	1.87 (1.52–1.94)	1.91 (1.69–2.12)	<0.001
Weekly renal CCr (L/1.73 m^2)	19.3 (8.89–36.2)	26.6 (11.6–43.7)	0.008
Weekly peritoneal CCr (L/1.73 m^2)	35.8 (27.9–42.7)	36.4 (22.7–58.1)	0.15
Weekly total CCr (L/1.73 m^2)	56.1 (48.3–68.2)	63.3 (54.6–77.9)	<0.001
Residual renal function (mL/min)	1.75 (0.79–3.27)	2.68 (1.25–4.24)	0.001
D/P Cr	0.77±0.13	0.78±0.11	0.61
Serum sodium (mmol/L)	138.6±2.17	139.1±1.85	0.06

Time-dependent associations between total sodium removal and mortality in patients on PD

Variable	Baseline total Na removal[a] Low < 2.67g/d <	High	*p* Value
Patients (*n*)	152	153	—
Systolic blood pressure (mmHg)	134±16.7	141±19.4	0.005
Diastolic blood pressure (mmHg)	79.8±11.6	81.2±12.9	0.40
Mean arterial pressure (mmHg)	98.1±11.4	100.9±13.4	0.10
Antihypertensive drugs (DDD)	1.29 (0.17–2.57)	1.69 (0.79–2.81)	0.07
Extracellular water (kg)	14.9±3.76	16.5±3.83	0.002
Intracellular water (kg)	14.0±4.05	15.2±4.02	0.03
Total body water (kg)	28.9±7.19	31.8±7.13	0.004
Extracellular water/total body water (%)	51.9±4.79	52.2±5.04	0.67
C-Reactive protein (mg/L)	2.17 (1.03–5.79)	2.78 (0.98–5.96)	0.84

Time-dependent associations between total sodium removal and mortality in patients on PD

Variable	Time-averaged total Na removal[a] Low < 2.67g/d <	High	*p* Value
Patients (*n*)	152	153	—
Daily total energy intake (kcal)	1274±305	1363±250	0.006
Daily total protein intake (g)	44.5±10.0	48.8±10.2	<0.001
Daily total carbohydrate intake (g)	176±44.9	185±44.7	0.06
Daily total fat intake (g)	49.6±15.9	52.8±10.9	0.04
Daily total sodium intake (g)	1.77±0.48	2.02±0.58	<0.001
Daily total potassium intake (g)	1.25±0.32	1.31±0.29	0.09
Daily total fiber intake (g)	6.89±3.11	7.09±2.11	0.51
Hemoglobin (g/L)	108±15.5	108±12.8	0.96
Albumin (g/L)	35.9±4.46	36.5±3.85	0.21
Prealbumin (mg/dL)	279±98	286±85	0.53
Lean body mass (kg)	33.6±8.22	39.5±9.04	<0.001
Left-hand grip strength (N)	194±86.9	208±99.1	0.09
Right-hand grip strength (N)	194±88.9	208±99.9	0.20

Time-dependent associations between total sodium removal and mortality in patients on PD

Time-Dependent Total Sodium Removal and Adjusted Variables Associated with Risk of Death in Time-Dependent Multivariate Regression Models

			All-cause mortality	Omnibus test for models	
	β	*p* Value	Hazard ratio (95% confidence interval)	Chi-square	*p* Value
Base model[a]				48.3	<0.001
Age (years)	0.03	0.001	1.04 (1.01 to 1.06)		
Charlson comorbidity index (per unit)	0.15	0.001	1.16 (1.09 to 1.22)		
Time-dependent D/P Cr	1.44	0.02	4.23 (1.23 to 14.5)		
Time-dependent total sodium removal	−0.18	0.04	0.83 (0.70 to 1.00)		
Base model + time-dependent RRF				48.7	<0.001
Age (years)	0.04	0.001	1.04 (1.01 to 1.06)		
Charlson comorbidity index (per unit)	0.15	0.001	1.16 (1.09 to 1.22)		
Time-dependent D/P Cr	1.45	0.02	4.26 (1.25 to 14.5)		
Time-dependent total sodium removal	−0.18	0.05	0.84 (0.70 to 1.00)		
Base model + time-dependent total protein intake				51.3	<0.001
Age (years)	0.33	0.002	1.03 (1.01 to 1.06)		
Charlson comorbidity index (per unit)	0.15	0.001	1.16 (1.09 to 1.23)		
Time-dependent D/P Cr	2.00	0.003	7.42 (1.94 to 28.4)		
Base model + time-dependent total energy intake				52.3	<0.001
Age (years)	0.03	0.007	1.03 (1.00 to 1.05)		
Charlson comorbidity index (per unit)	0.15	0.001	0.16 (1.09 to 1.22)		
Time-dependent D/P Cr	2.12	0.002	8.29 (2.18 to 31.6)		
Time-dependent total energy intake	−0.001	0.05	1.00 (0.99 to 1.00)		
Base model + time-dependent albumin				58.9	<0.001
Age (years)	0.03	0.01	1.03 (1.00 to 1.05)		
Charlson comorbidity index (per unit)	0.15	0.001	1.16 (1.09 to 1.23)		
Time-dependent D/P Cr	2.01	0.001	7.49 (2.23 to 25.1)		
Time-dependent albumin	−0.03	0.005	0.97 (0.95 to 0.99)		
Base model + time-dependent lean body mass				57.1	<0.001
Age (years)	0.02	0.04	1.02 (1.00 to 1.05)		
Charlson comorbidity index (per unit)	0.16	0.001	1.16 (1.09 to 1.23)		
Time-dependent D/P Cr	2.01	0.001	7.46 (2.19 to 25.4)		
Time-dependent lean body mass	−0.03	0.008	0.97 (0.95 to 0.99)		

PDI 2011;31(4):412-421

CONCLUSIONS

The present study suggests that the association of time-dependent TSR and mortality is confounded by parameters of dietary intake and nutrition in patients on PD. Moreover, more attention should be paid to a continuously low TSR because it may indicate worse nutrition status. Further, to prevent the bias of treatment effect, clinical trials designed to determine the efficacy of low-sodium dialysate on sodium removal will need to take baseline dietary intake into consideration.

Hyponatremia and Cognitive Impairment in Patients Treated with Peritoneal Dialysis

Table 1. Differences in clinical characteristics between PD patients without and with hyponatremia

Variable	Total	Patients without Hyponatremia	Patients with Hyponatremia	*P* Value
Patients, *n* (%)	476	426 (89.5)	50 (10.5)	–
Serum sodium (mmol/L)	139.1±3.1	139.8±2.4	133.1±1.9	<0.001
Age (yr)	51.9±14.3	51.4±14.3	55.9±13.2	0.04
Men (%)	244 (51.4)	221(51.9)	23 (46.0)	0.42
PD duration (mo)	26.3 (12.2–49.9)	26.3 (12.0–49.2)	29.7 (13.0–54.0)	0.36
Primary kidney disease, *n* (%)				0.36
Diabetic nephropathy	99 (20.8)	86 (20.4)	13 (26.0)	
Hypertensive nephropathy	77 (16.1)	66 (15.6)	11 (22.0)	
Chronic GN	207 (43.6)	187 (44.5)	20 (40.0)	
Other	93 (19.5)	87 (19.5)	6 (12.0)	
Diabetes mellitus, *n* (%)	113 (23.7)	97 (22.7)	16 (32.7)	0.12
Cardiovascular disease, *n* (%)	95 (20.1)	86 (20.4)	9 (18.0)	0.69
Charlson index	5 (3–8)	5 (3–8)	5 (2–8)	0.93
Level of education, *n* (%)				0.02
Elementary school or lower	92 (19.3)	74 (17.3)	18 (36)	
Middle school	145 (30.4)	133 (31.1)	12 (24)	
High school	141 (29.6)	130 (30.4)	11 (22)	
Above high school	98 (20.7)	89 (21.1)	9 (18)	
Body mass index (kg/m^2)	23.0±3.5	23.0±3.5	22.9±3.5	0.97
Systolic BP (mmHg)	135.9±18.7	135.3±18.8	141.9±17.2	0.02
Diastolic BP (mmHg)	82.4±12.3	82.5±12.6	82.1±9.4	0.84
Mean arterial pressure (mmHg)	100.3±13.0	100.1±13.3	102.0±10.3	0.34
Hemoglobin (g/L)	103.3±18.1	105.0±17.9	98.2±19.1	0.01
Serum albumin (g/L)	36.1±5.6	36.5±5.4	32.5±5.7	<0.001
hsCRP (mg/L)	2.96 (0.99–8.70)	2.82 (0.91–8.36)	5.90 (1.67–12.1)	0.03
RRF (ml/min)	1.39 (0.00–3.77)	1.43 (0.00–3.89)	0.63 (0.00–2.93)	0.15
Total Kt/V	1.91±0.55	1.88±0.41	1.92±0.46	0.51
Total Ccr (ml/min per 1.73 m^2 per week)	57.9±19.6	57.8±16.9	56.5±23.6	0.64

Values are expressed as mean±SD, median (interquartile range), or number (percentage). PD, peritoneal dialysis; hsCRP, high-sensitivity C-reactive protein; RRF, residual renal function; Ccr, creatinine clearance.

CJASN 2015;10:1806–1813

Hyponatremia and Cognitive Impairment in Patients Treated with Peritoneal Dialysis

Table 2. Differences in cognitive function measures between PD patients without and with hyponatremia

Variable	Total	Patients without Hyponatremia	Patients with Hyponatremia	*P* Value
Patients, *n* (%)	476	426 (89.5)	50 (10.5)	–
3MS score	84.0±12.8	84.7±12.3	76.7±15.9	<0.001
Cognitive impairment, *n* (%)	132 (28.4)	108 (25.8)	24 (52.2)	<0.001
Trails A (s)	66 (47–95)	65 (46–92)	86 (64–120)	0.002
Trails B (s)	148 (106–235)	144 (105–229)	198 (132–415)	0.004
Executive dysfunction, *n* (%)	134 (30)	114 (28.1)	20 (48.8)	0.006
Immediate memory score	73.1±17.9	73.7±17.9	67.3±17.8	0.02
Delayed memory score	88.2±17.2	88.9±16.7	81.5±20.7	0.03
Language ability score	92.5±13.8	93.0±13.7	87.8±13.4	0.02

Values are expressed as mean±SD or number (percentage). 3MS, Modified Mini-Mental State Examination; Trails A, trail making test A; Trails B, trail making test B.

CJASN 2015;10:1806–1813

Hyponatremia and Cognitive Impairment in Patients Treated with Peritoneal Dialysis

In conclusion, this is the first multicenter study with a large sample size to investigate the cognitive impairment prevalence and comprehensively assess cognitive function in an Asian PD population. Our findings support the hypothesis that hyponatremia is associated with cognitive impairment in dialysis patients. Further interventional studies are needed to observe the effect of correcting hyponatremia on the improvement of cognitive impairment and patient survival.

CJASN 2015;10:1806–1813

Individualisierter Behandlungsplan für PD

- Verweilzeit an Transporteigenschaften anpassen (D/P_{Krea})
- Patient anweisen Wasserzufuhr einzuschränken
- Hypertone PDFs vermeiden (keine hohe Gluc.%)
- Biokompatible PDFs
- Hydratationszustand beurteilen

Renale Restfunktion erhalten (RRF)

- Urinvolumen messen
- Kreatinin-Clearance

Peritoneale Funktion erhalten

Volumenstatus kann besser gewährleistet werden

Verbesserte Methode

Patientenüberleben ⬆

Technisches Überleben ⬆

KI 2013,85:15–17

Agenda

Das Update umfasst Neuigkeiten zu den folgenden Punkten:

- Bedeutung Transporteigenschaften / EPS / Aquaporine
- Heim-HD versus PD
- Kochsalz und PD
  - Kochsalzarme Dialysatlösungen
  - Erfahrungen aus China (Kochsalz bei PD)
  - Hyponatriämie und kognitive Funktionen
- Europäische Daten HD / PD

Peritoneal dialysis or haemodialysis in end-stage renal disease: do registry data matter?

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1. Mortalität von Dialysepatienten in Europa sinkt! (36% in PD und 18% in HD, wenn 2003–07 und 1993–97 verglichen werden).

2. PD wird weniger genutzt (22% 1993–97 versus 18% 2008–12, entspricht 18% Abnahme)

3. PD ist HD in der Periode 2003-07 hinsichtlich Mortalität um 9% überlegen.

NDT 2016:31: 6–7

Trends in dialysis modality choice and related patient survival in the ERA-EDTA Registry over a 20-year period

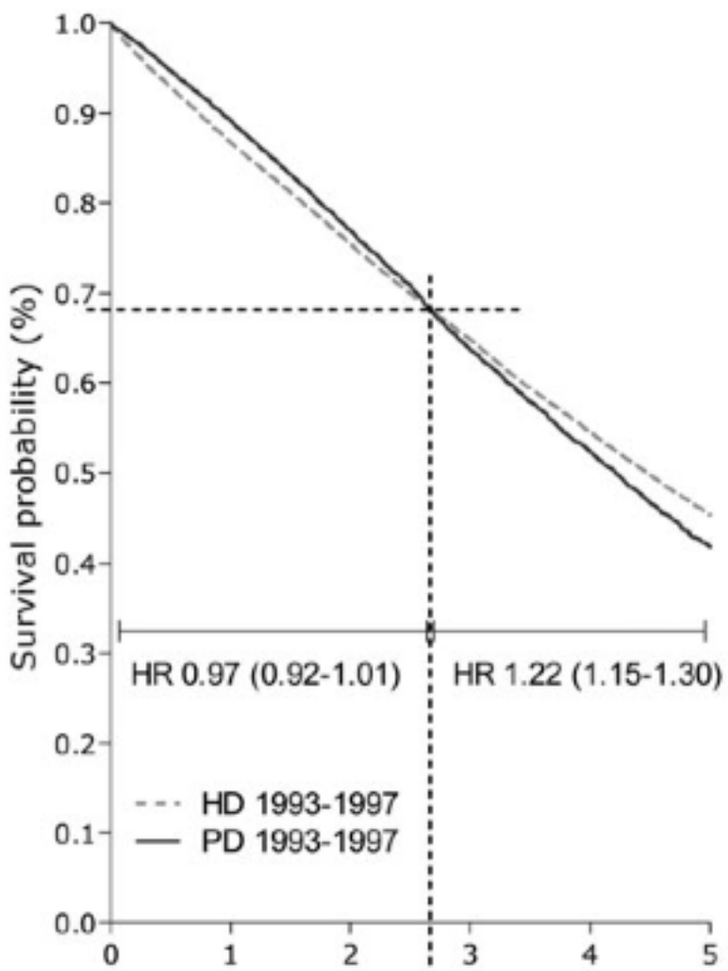
Quelle: 196 076 Patienten des „European Renal Association-European Dialysis and Transplant Association (ERA-EDTA) Registry“ welche einen Nierenersatz zwischen 1993 und 2012 begonnen haben.

Beobachtungsmerkmale: Trends in Inzidenz und Prävalenz, 5-Jahres-Mortalität und Methodenüberleben.

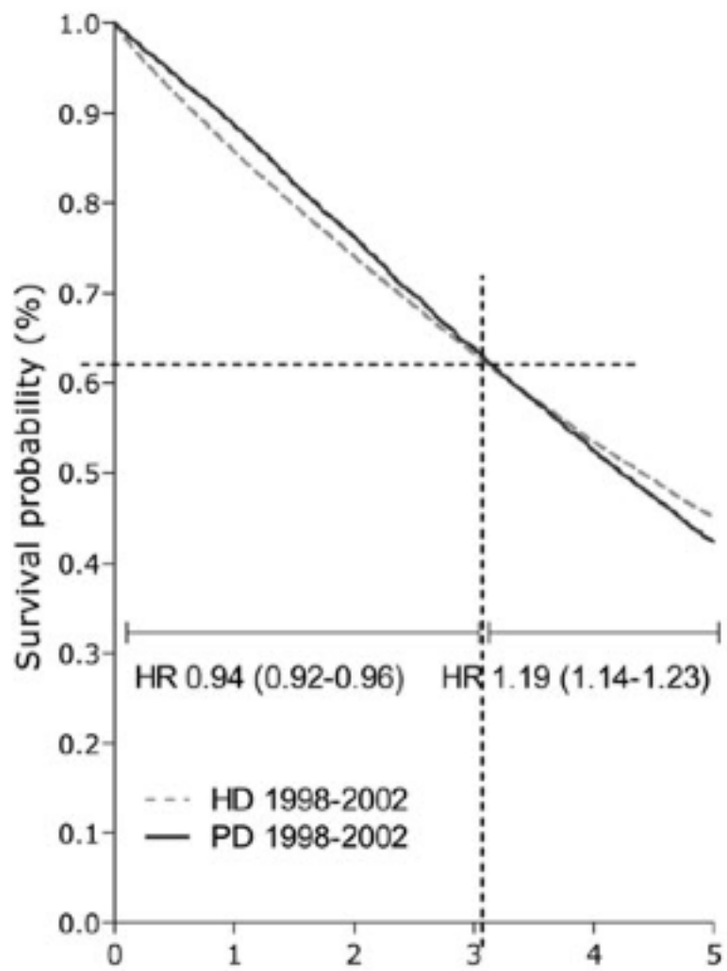
NDT 2016;31:120–128

Trends in dialysis modality choice and related patient survival in the ERA-EDTA Registry over a 20-year period

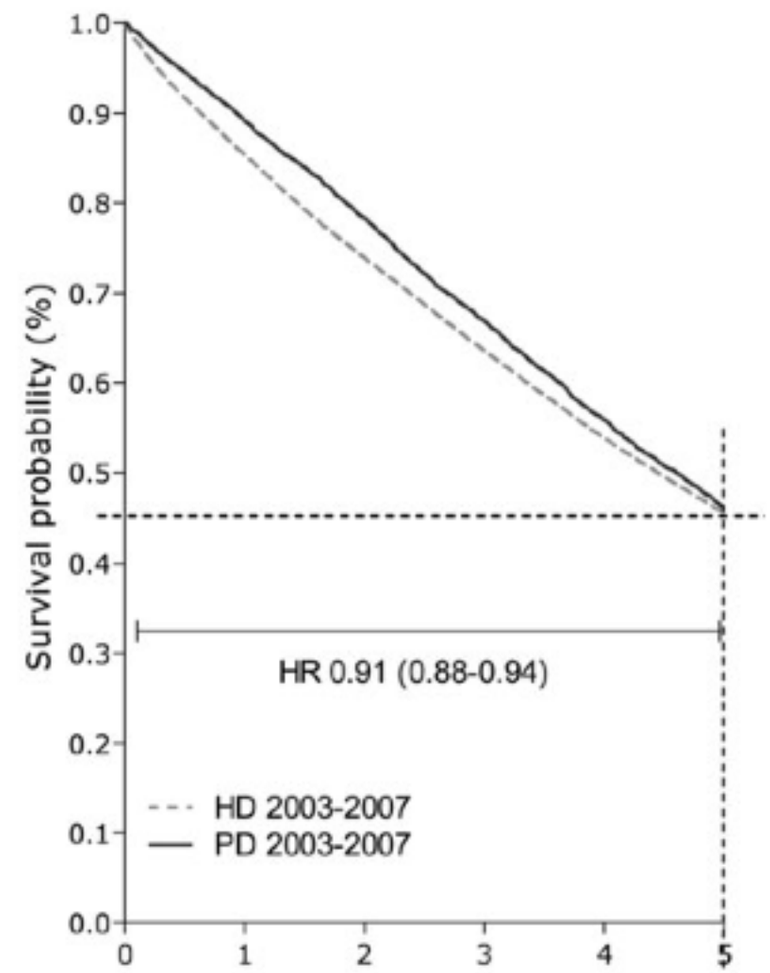
1993-1997



1998-2002



2003-2007



adjusted for age, sex, primary renal disease and country

NDT 2016;31:120–128

Trends in dialysis modality choice and related patient survival in the ERA-EDTA Registry over a 20-year period

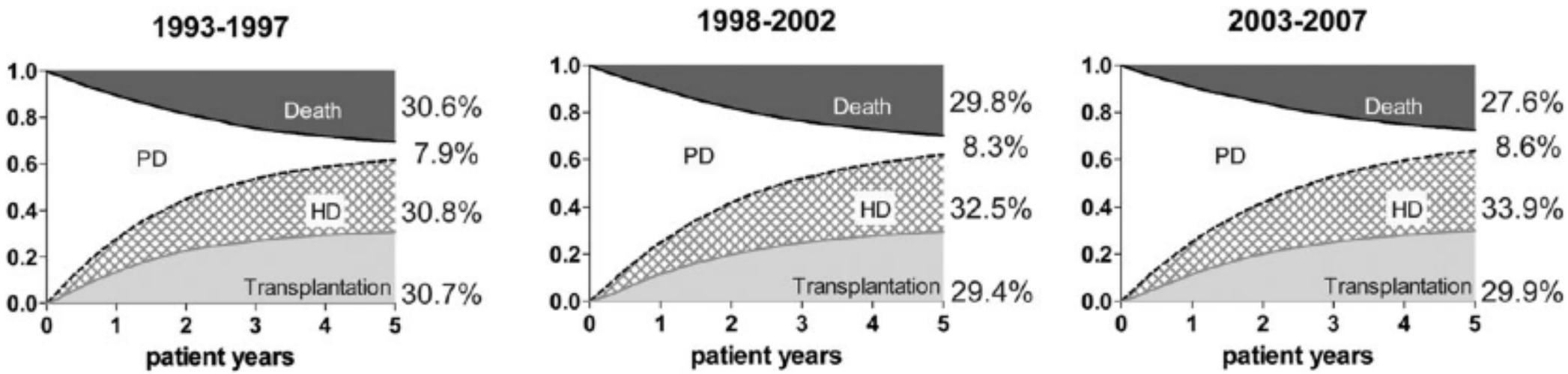


FIGURE 3: Unadjusted cumulative incidence survival curves for event-free survival, transfers to HD or occurrence of transplantation and death for patients who started PD in 1993–97, 1998–2002 and 2003–07.

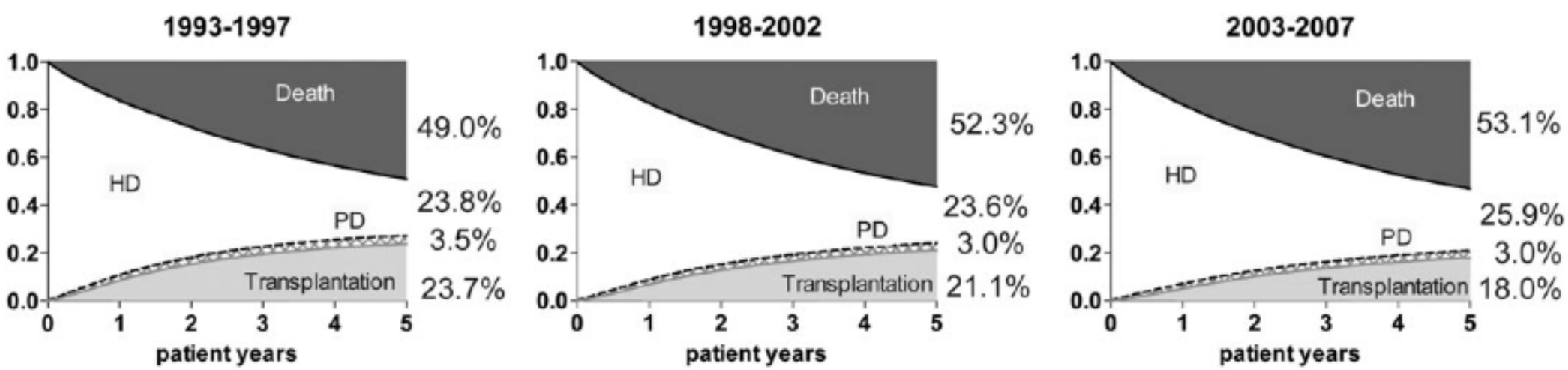


FIGURE 4: Unadjusted cumulative incidence survival curves for event-free survival, transfers to PD or occurrence of transplantation and death for patients who started HD in 1993–97, 1998–2002 and 2003–07.

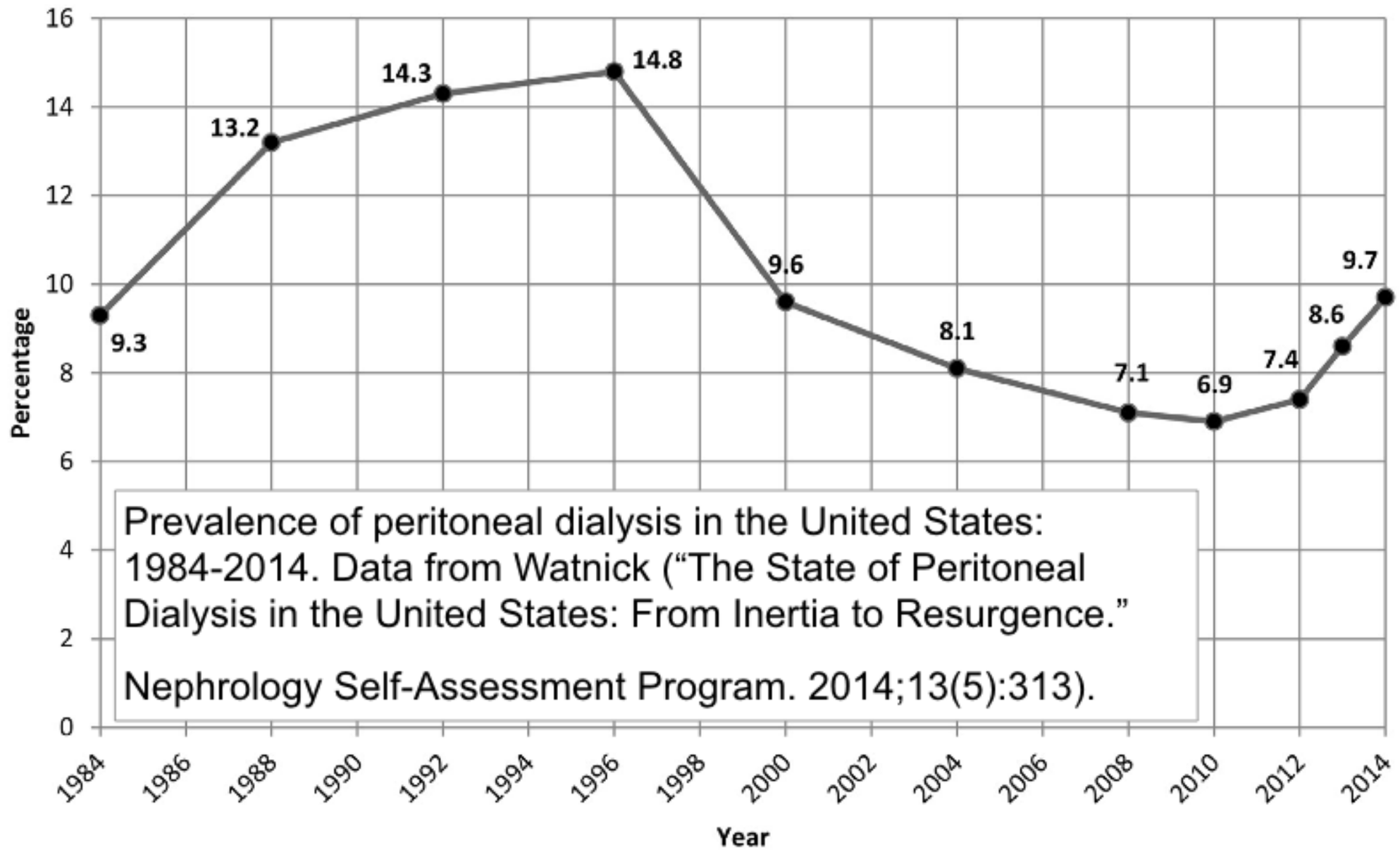
NDT 2016;31:120–128

Trends in dialysis modality choice and related patient survival in the ERA-EDTA Registry over a 20-year period

In conclusion, we observed a significant decline in PD use and a stabilization in HD prevalence between 1993 and 2012 in 14 renal registries from 11 European countries. The probability of receiving a kidney transplant while on dialysis did not increase over time, so the sole reason for the decreased dialysis use was the lower incidence rate. **Overall, initiating RRT on PD treatment was associated with favourable survival outcomes when compared with starting on HD treatment.** In the absence of medical or social contraindications, PD can offer some important benefits, including patients' autonomy and lower costs of the treatment in general. Nevertheless, despite the survival benefits for PD over HD in most patient groups, this study shows that PD is often not preferred as the first dialysis modality. **With the steadily accumulating evidence in favour of PD as a first dialysis modality choice, future studies and initiatives need to focus on the underlying clinical and social factors to explain this phenomenon and to identify solutions that may turn the tide.**

NDT 2016;31:120–128

Update on Peritoneal Dialysis: Core Curriculum 2016



Prevalence of peritoneal dialysis in the United States: 1984-2014. Data from Watnick ("The State of Peritoneal Dialysis in the United States: From Inertia to Resurgence."

Nephrology Self-Assessment Program. 2014;13(5):313).

Am J Kidney Dis. 2016;67(1):151-164