

# PD without Residual Kidney Function: Should We Keep Going?

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# Disclosure

- ▶ **Speaker Bureau**

- ▶ PD Excellence Academy
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- ▶ **Honorarium**

- ▶ UpToDate

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# Case presentation

- ▶ 65y/m with DM, CAD s/p stenting, ESRD on PD, active on transplant list but no donor
  - ▶ started with Residual kidney function (RKF) 4 ml/min
  - ▶ PET 0.56
  - ▶ NIPD – 2.3 lt x 3 exchanges over 9 hours
- ▶ Over next two years, his PD script was slowly increased to match the loss in his kidney function.
- ▶ Current prescription
  - ▶ 2.3 lt x 4 exchanges over 9 hours
  - ▶ 2 lt last fill
- ▶ Recently, < 50 cc urine/day
  - ▶ Clinically: no anorexia, weight loss, fatigue, insomnia
  - ▶ Labs: Hgb at goal on stable ESA dose, CO<sub>2</sub>; 25 meq/L, K: 3.8 meq/L
  - ▶ Intermittently high Phos and PTH: since the beginning of dialysis.
  - ▶ Kt/V 1.58

# Should We Continue on PD or Transfer to HD?

- ▶ Yes
- ▶ No
- ▶ May be

# Why are we asking this question?

▶ CANUSA - Prospective cohort study of 680 PD patients in Canada and USA for 3 years

▶ Re-analysis of variables as predictors

▶ Retrospective review to study the cause of death

▶ 296 peritoneal dialysis over a 7-year

Over-interpretation of data – low RKF is not good for PD patients.

Age		
CVD		
Diabetes mellitus	1.25	0.769–2.036
Serum albumin	0.96	0.912–1.000
LA transport	1.66	0.379–7.218
HA transport	2.33	0.554–9.801
H transport	2.01	0.430–9.357
SGA	0.74	0.647–0.842
Ccrp (5 L/wk per 1.73 m <sup>2</sup> greater)	1.00	0.898–1.105
GFR (5 L/wk per 1.73 m <sup>2</sup> greater)	0.88	0.829–0.943

<sup>a</sup> CVD, cardiovascular disease; LA, low average; HA, high average; H, high; SGA, subjective global assessment.

		(patient-year)		
Causes of death				
Vascular diseases	82	60	1.96 (1.42–2.71)	<0.0001
Infections	41	41	1.44 (0.94–2.20)	0.1
Others	26	46	0.81 (0.51–1.31)	0.39
All causes	149	147	1.46 (1.18–1.80)	0.0005

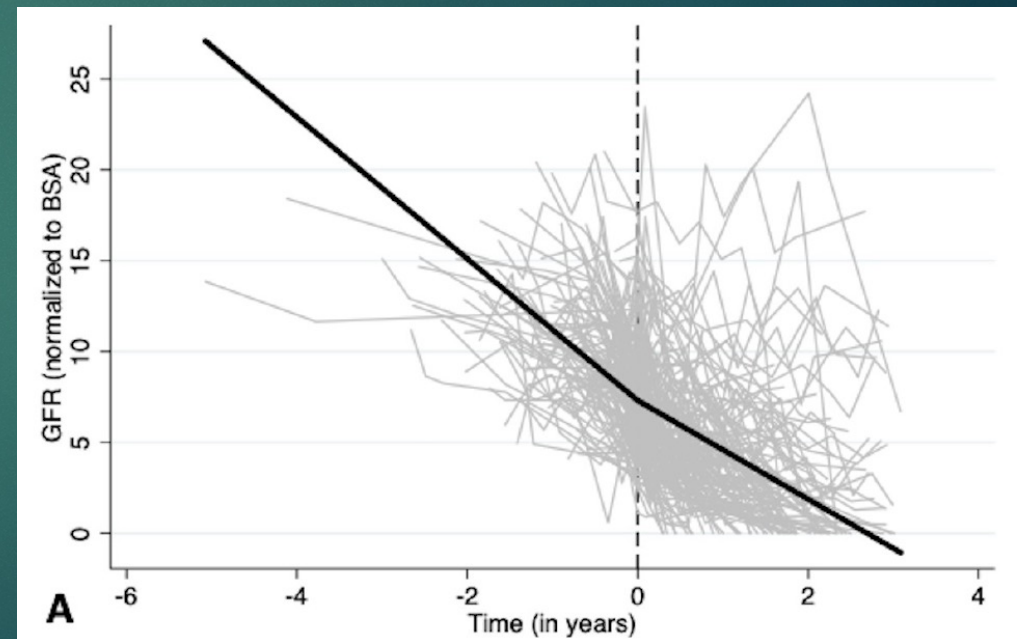
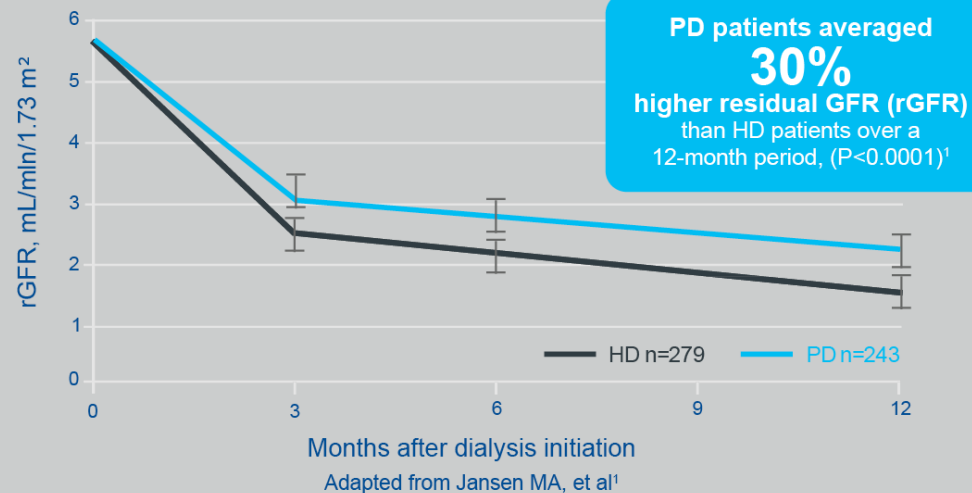
# Better preservation of RKF in PD

- ▶ NECOSAD2 - 24-hour average urine urea and creatinine clearance

- ▶ IDEAL study - average of 24-hour urine urea and creatinine clearance

- ▶ Before:  $-4.09 \pm 0.33 \text{ mL/min/1.73m}^2/\text{yr}$
- ▶ After:  $-2.69 \pm 0.18 \text{ mL/min/1.73m}^2/\text{yr}$

RKF in Patients Receiving Peritoneal Dialysis (PD) vs Hemodialysis (HD) Using Standard Dialysis Fluid<sup>1</sup>



# Reverse Psychology

- ▶ PD preserves RKF better
- ▶ Survival in PD patients depends on residual kidney function
- ▶ Multiple commentaries
  - ▶ Peritoneal clearances are not equivalent to clearances achieved by kidneys
    - ▶ Better management of anemia
    - ▶ Better control of hyperphosphatemia
    - ▶ Better volume and BP control
- ▶ So prevailing opinion: once RKF is gone, it is not good for the PD patients.

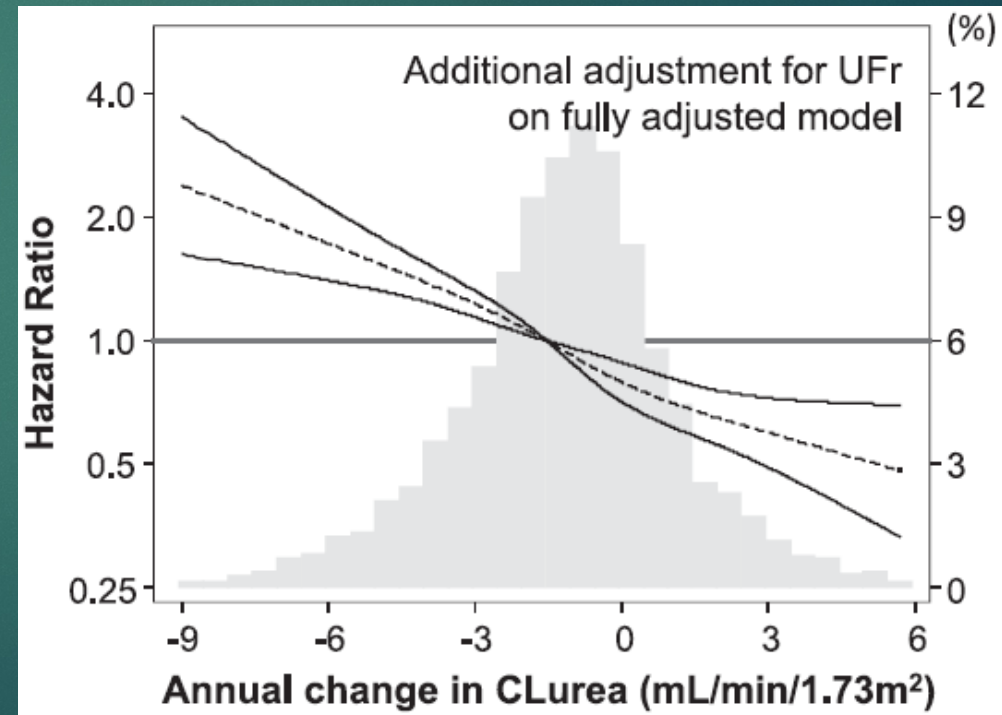
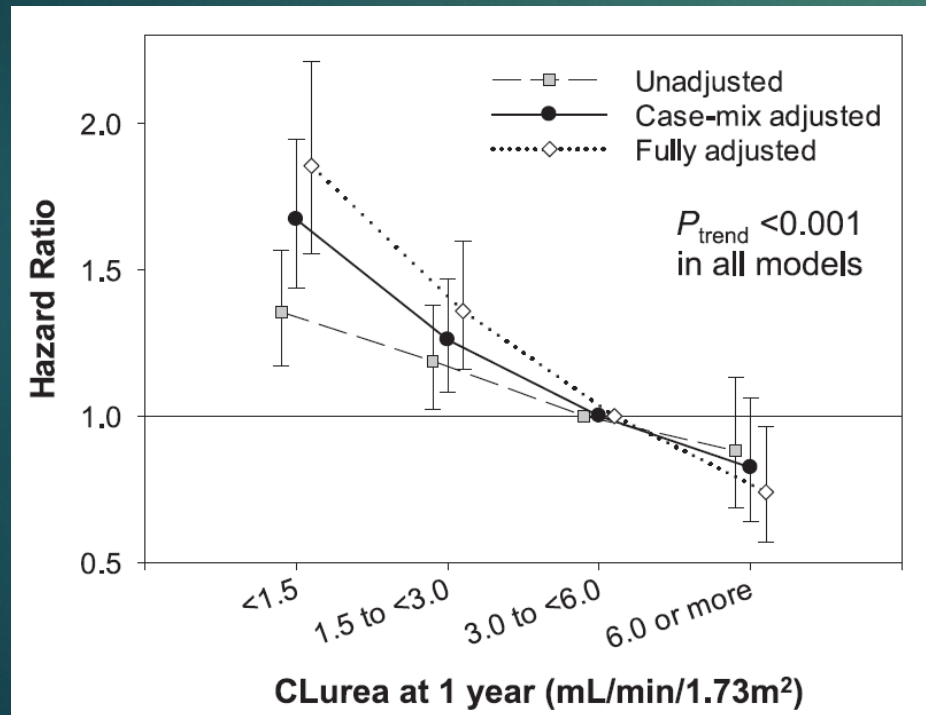
# Transfer to Hemodialysis (Technique Failure) due to inadequate dialysis (real or perceived)

- ▶ **Canadian PD patients: temporal trends in 2000-2009 compared to 1995 to 2000 (n=13,000)**
  - ▶ Inadequate PD – increased in 2001-2005 but decreased in 2005-2009
  - ▶ Reduced peritonitis but no difference in peritonitis related technique failure in 2001-2009 cohort compared to 1995-2000
- ▶ **Australia/New Zealand 1989-2014 cohort (n=9,649)**
  - ▶ Infection (52%)
  - ▶ Inadequate dialysis (19%)
  - ▶ Mechanical failure (18%) and Social reasons (11%)



# Mortality on HD with progressive loss of RKF

- ▶ longitudinal cohort of 6538 patients on MHD over a 4-year period (2007 -2010)
- ▶ had renal urea clearance (CL<sub>urea</sub>) data at baseline and 1 year after initiation



# The goal is to provide adequate dialysis. What is adequate dialysis?

- ▶ **Not just Kt/V**
- ▶ The ability of the dialysis patients to meet the needs and demands of the body at all times to maintain satisfactory performance in the steady state.
- ▶ **In broad sense control of**
  - ▶ Generalized well being including functional status
  - ▶ BP and volume status
  - ▶ Acid base homeostasis and nutrition
  - ▶ Cardiovascular risk
  - ▶ Mineral and bone disorders
  - ▶ Small and middle molecule clearance



# Small solute clearance in Anuric PD Patients

- ▶ Retrospective cohort study of anuric PD patients, n=122, 1992-1997
- ▶ Number of patients achieving target kt/V

Type of Peritoneal Dialysis (CAPD, APD) and the Number of Patients with Urea and Creatinine Clearances (CCr) Above Targets Recommended by DOQI (Weekly Kt/V of 2 for CAPD, 2.2 for APD; Weekly CCr of 60 L/week for CAPD, 66 L/week for APD)

	CAPD	APD
Total	89	26
Weekly Kt/V <sup>a</sup>	2.07±0.31	2.6±0.6
Weekly CCr <sup>a</sup> (L/1.73 m <sup>2</sup> )	57.3±8.5	65.7±18.1
Dialysate volume <sup>a</sup> (L/24 hr)	9.3±1.5	15.7±2.8
Patients with weekly Kt/V above targets (N)	51 (57%)	21 (81%)
Patients with weekly CCr above targets (N)	31 (35%)	9 (35%)

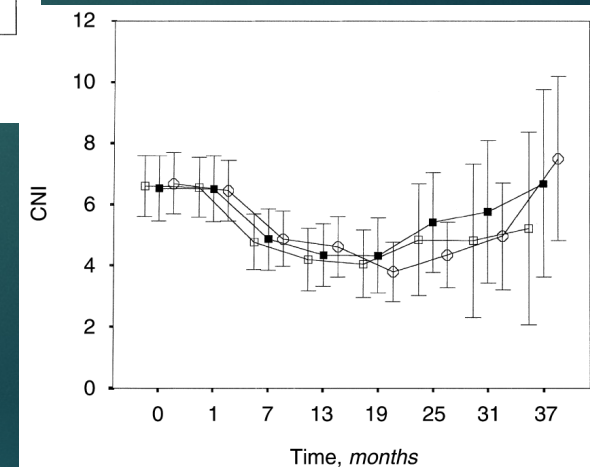
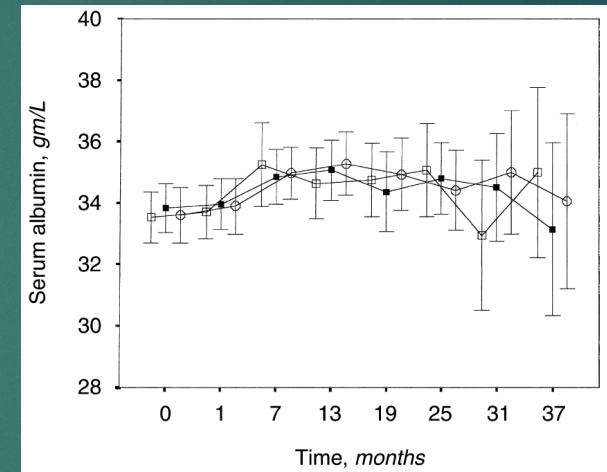
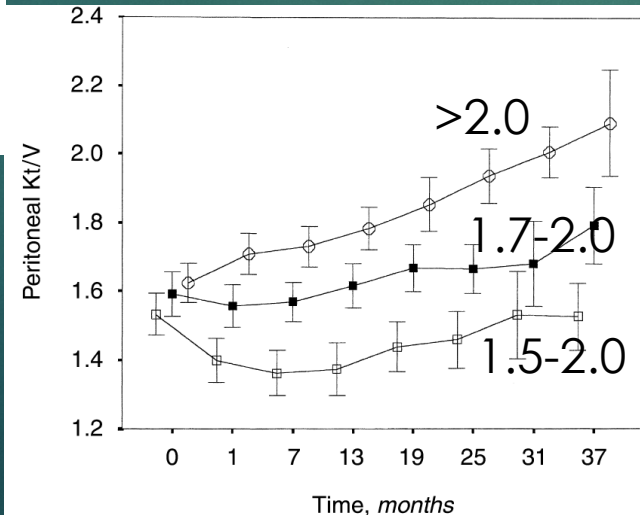
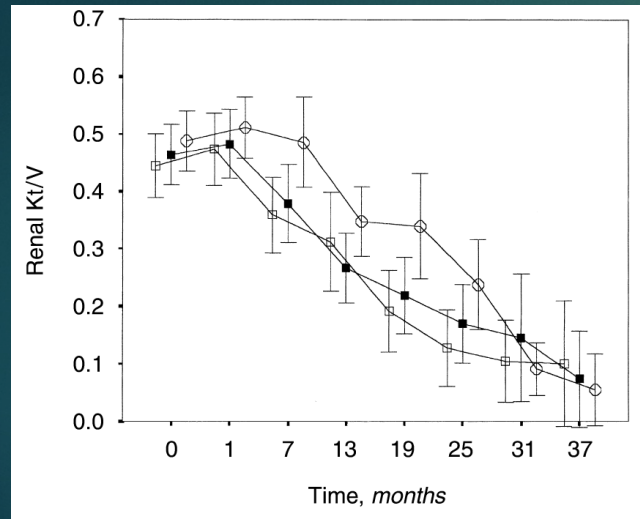
<sup>a</sup> Mean ±SD.

- ▶ Mortality was better with kt/v>1.85
- ▶ No association between kt/V and technique failure

# Hong Kong PD Adequacy Study: Drop in RKF didn't associate with poor nutrition

Drop in RKF and increase in peritoneal clearance over 3 years

No change in albumin or Composite nutrition index (CNI)

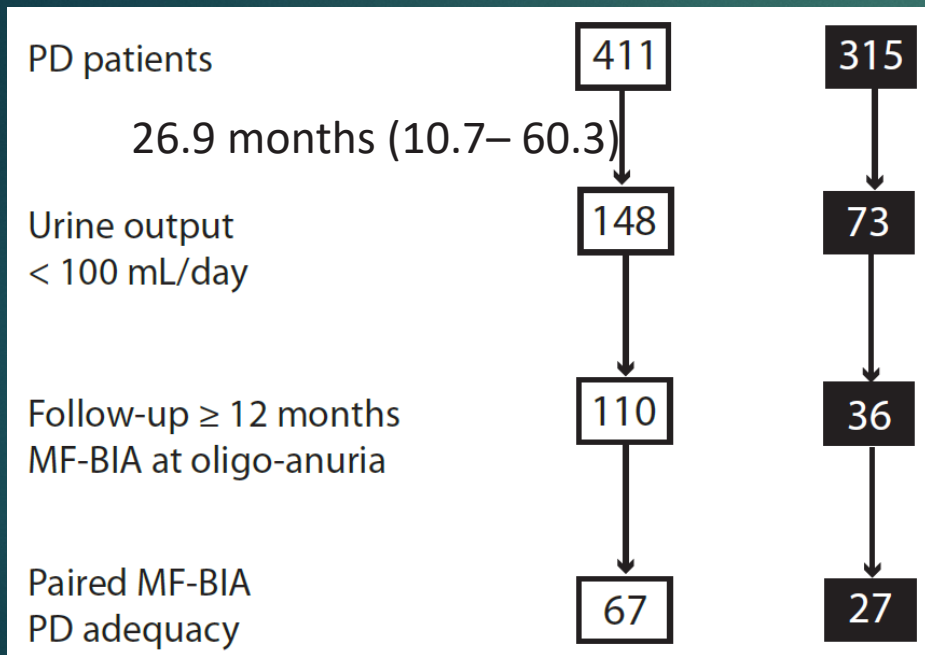


# No difference in weight and markers of nutrition

	Anuric	Not anuric	RR (95% CI)	<i>P</i> -value
Population of dialysis (patient-year)	1030	1480		
<b>Causes of death</b>				
Vascular diseases	82	60	1.96 (1.42–2.71)	<0.0001
Infections	41	41	1.44 (0.94–2.20)	0.1
Others	26	46	0.81 (0.51–1.31)	0.39
All causes	149	147	1.46 (1.18–1.80)	0.0005

	Anuric	Not anuric
No. of patients	149	147
Duration of dialysis (months)	59.7 ± 30.3	23.3 ± 22.4
<b>Body weight (kg)</b>	<b>58.2 ± 10.3</b>	<b>59.7 ± 9.4</b>
Body height (m)	1.61 ± 0.09	1.62 ± 0.08
Kt/V	1.62 ± 0.33	1.64 ± 0.36
CCr (l/week/1.73 m <sup>2</sup> )	41.0 ± 9.5	46.0 ± 11.8
<b>Serum albumin (g/l)</b>	<b>26.1 ± 4.7</b>	<b>26.4 ± 4.8</b>
<b>NPNA (g/kg/day)</b>	<b>0.91 ± 0.16</b>	<b>0.92 ± 0.22</b>
<b>%LBM</b>	<b>59.6 ± 10.6</b>	<b>57.8 ± 11.6</b>

# Blood Pressure and Volume Status in Anuric PD Patients

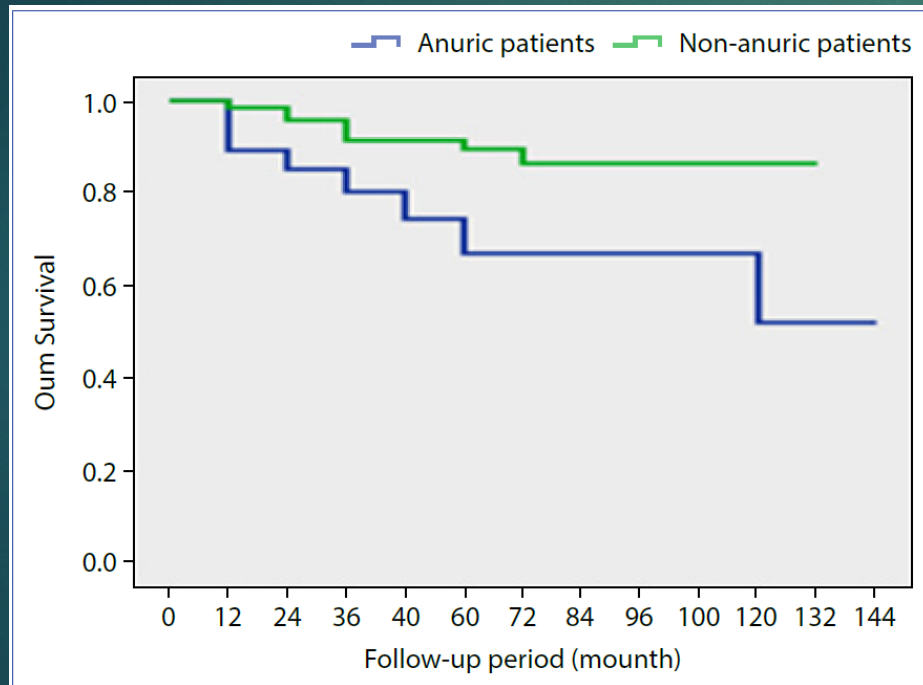


	Oligo-anuric	On follow-up <sup>a,b</sup>
Weight (kg)	69.3±14.5	69.3±15.4
SBP (mmHg)	138.9±29.1	134.9±26.3
DBP (mmHg)	81.3±17.3	78.6±15.6
MAP (mmHg)	100.6±19.6	97.4±7.6
BP meds	1 (0–2)	1 (0–1) ( <i>p</i> =0.09)
ECW (L)	14.9±3.4	14.6±3.4
ECW/TBW	0.45±0.05	0.45±0.05
ECW-OH (L)	0.55 (-0.26–1.4)	0.4 (-0.22–1.4)

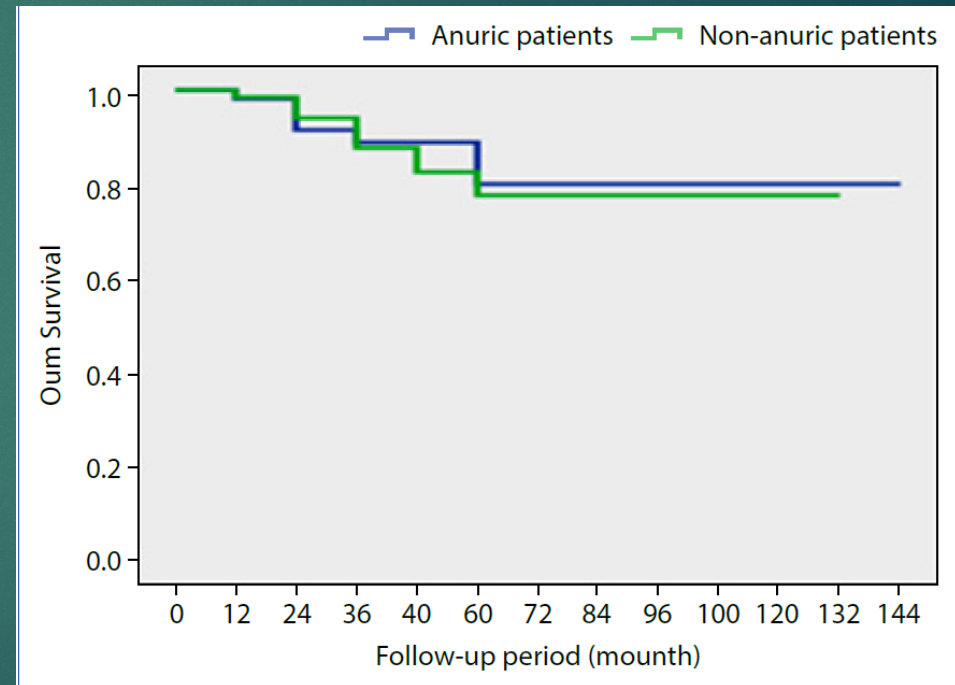
- ▶ Kt/v: 1.89
- ▶ 48% to 72% icodextrin

# RKF and Technique Failure: Turkey Experience

- ▶ 2000-2010: At the PD initiation, 58 patients with anuria and 144 patients without anuria.



Patient Survival



Technique Survival

# Bottom Line, so far

- ▶ Residual kidney function impacts the survival and quality of life of dialysis patients.
- ▶ Its longer preservation is a major advantage to any dialysis patient (hemo or PD) and should be the goal for every dialysis patient.
- ▶ Anuric patients no longer benefit from such advantage, depend on dialysis to achieve adequate solute and volume control.
- ▶ This challenge can be successfully dealt with by individualizing the dialysis prescription and lifestyle changes.
  - ▶ More APD use
  - ▶ Icodextrin use for volume homeostasis
- ▶ PD allows a satisfactory patient survival while keeping the benefits of home dialysis and preserving vascular network.
- ▶ An integrated and individualized care plan – responsibilities lie on us



# Response to Inadequate Dialysis – CMS ESRD PD Clinical Performance Measures Project

	Time Period 1	Time Period 2	Total	No. (%) of Patients
Kt/V < 2.0 and CrCl < 60.0 L/week/1.73m <sup>2</sup> (no. of patients)	127	61	188	
Change in prescription (no. of patients)	56	25	81	
Changed prescription information recorded	46	19	65	
Change in total prescribed daily volume				
+ 2000 mL				35 (55)
+ 2500 mL				11 (17)
+ 3000 mL				6 (9)
Other volume change				12 (19)
Change in number of exchanges				
From				
3 exchanges → 4 exchanges				3 (5)
4 exchanges → 5 exchanges				26 (41)
5 exchanges → 6 exchanges				3 (5)
4 exchanges → 6 exchanges				1 (2)
No change in number of exchanges				31 (48)

- ▶ 60% were anuric
- ▶ Other reasons
  - ▶ High BSA or Vd
- ▶ 78-86% had improved Kt/V after change in script.

# Approach

- ▶ Preservation of RKF
- ▶ Adequate solute clearance and maintenance of volume homeostasis while being cognizant of burden of increased exchanges or extra volume on quality of life
- ▶ Volume homeostasis
  - ▶ Constant reminder of need of healthy dietary behaviors
  - ▶ Icodextrin for long fills to avoid neg UF, rather gain some positive UF
  - ▶ Careful review of flowsheets to monitor drain times and UF
    - ▶ Constipation is common in this patient population and leads to poor catheter function



2 slices of bread = 800 mg  
Slice of cheese = 300 mg  
Layer/s of meat = 800 mg  
Mayo = 100 mg  
Mustard = 100 mg  
Bag of chips = 250-500 mg

Na = 2600 mg  
Added inorg PO<sub>4</sub>

# Achieving Solute Clearance

- ▶ Automated PD
  - ▶ Allows more frequent exchanges and higher total volume
  - ▶ Increase small solute clearance
- ▶ Increase dwell volume
  - ▶ Nighttime to up to 3 lt
- ▶ Last fill and Mid-day exchange (post work)
  - ▶ Increase middle molecule clearance
- ▶ Use of adjusted body weight to calculate  $V_d$  in obese patients since the body water proportion is less in adipocytes
  - ▶ Adjusted wt = Ideal weight + [0.4 x (actual wt – ideal wt)]
- ▶ Limitations
  - ▶ High muscle mass, low transporter status

# PD without Residual Kidney Function: Should We Keep Going?

- ▶ YES, as long as adequate dialysis is achieved
  - ▶ Patient is happy, functional and free of uremic symptoms
  - ▶ Achieves euvolemia and good BP control
  - ▶ Meets anemia goals, control of acidosis, hyperkalemia etc.
  - ▶ Kt/V may or may not be at goal

**THANK YOU!**