



WESTERN
CANADA

PD
DAYS

February 7th-9th, 2013

PD In Acute Kidney Injury

Objectives

- PD as a viable initial therapy
 - PD in AKI
 - PD versus dHd
 - PD versus CVVHD
- Why not PD first

PD for AKI

- Early days (1970's) PD was the option of choice for RRT even in AKI
- IPD most commonly used
- Western countries shift to HD
 - Newer technology – CRRT
 - More biocompatible membranes

PD for AKI

- Balbi et al Brazil
 - PDI May 2007 – pilot study
 - Prospective Cohort in 2004
 - Inclusion Criteria
 - AKI from ischemic or nephrotoxic agent
 - Indications: BUN >100, uremic symptoms, volume overload, electrolyte abnormalities.
 - Excluded if CKD, transplant, or abdominal surgery (recent or multiple)

PD for AKI

- Study Protocol
 - CPD session was 24 hours of dialysis
 - Blind placement of Tenckhoff
 - Prescribed dose Kt/V 0.65
 - Cycler 2L exchanges with 35-50 min dwell time
 - 36-44 L per day with 18-22 exchanges per day

PD for AKI

- Measurements
 - After each session
 - Serum , urine and dialysate analyzed to calculate Cr and urea clearance, delivered dialysis dose
- Protocol suspended:
 - Urine output >1000 ml per day with drop in Cr and urea
 - Need to change modality, death or 30 days

PD for AKI

- Dialysis Dose
 - Prescribed Kt/V:
 - volume of dialysis over 24 hours x 0.60 (medium transport)
 - V - Watson or Dubois
 - Delivered Kt/V
 - $[\text{Dialysate urea/serum urea}] / [\text{drained dialysate volume/urea distribution volume}]$
 - Correction factor of 0.8 applied because urea distribution in AKI

PD for AKI

- Results
 - 30 patients with 236 sessions of PD
 - Age: 59 +/- 7 years
 - 67% male
 - 84% Caucasian
 - BSA 1.65

PD for AKI

- 76% in ICU with Apache 2 scores of 32.2
- AKI from ischemia/ATN,
- Dialysis for uremia (50%) and volume overload (28%)

- Median number of PD sessions 6
 - Interquartile range 6-10

PD for AKI

- PD limitations
 - Slow efficiency
 - Not effective for poisoning, overdoses, severe acute respiratory illness
 - ICU
 - Increased intra-abdominal pressure
 - Increased glucose
 - Increased CO₂

PD for AKI

- Prescribed Kt/V
 - Session 0.65
 - Weekly 4.5
- Delivered Kt/V
 - Session 0.55+/-0.12
 - Weekly 3.85+/-0.62
- Cr clearance 110+/- 22 L/week

PD for AKI

- Complications
 - Peritonitis 16.7%
 - Inadequate dialysis 2 patients
 - No mechanical complications
- Mortality: 57%
- Renal Recovery 23%
- Ongoing Chronic RRT 13%

PD for AKI

- Adequate volume and electrolyte control with PD
- Urea control seemed adequate
- Was dialysis dose adequate?
 - Is Kt/V reliable

PD for AKI

- Mortality
 - Comparable to most studies in the area
- Complications
 - Peritonitis was Pseudomonas and Fungal
 - Similar to other PD studies in this area

PD versus dHd

- Balbi et al 2009.
- Same group with same protocol for PD
- Randomly compared PD versus dHd

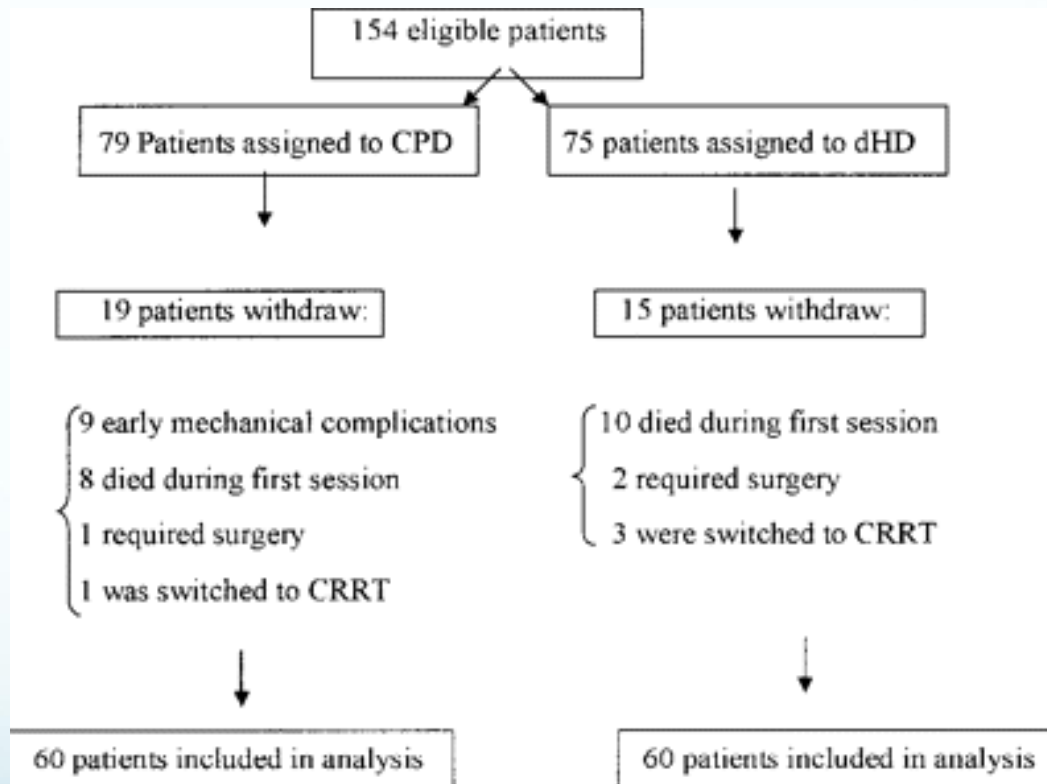
PD versus dHd

Characteristic	CPD	Daily HD	<i>p</i> Value
Patients (<i>n</i>)	60	60	
Male sex (%)	72	66	0.52
Age (years)	64.2±19.8	62.5±21.2	0.3
Volemia (L)	34.9±10.1	35.8±9.2	0.81
Diuresis (mL)	280	278	0.79
	(42.5–795)	(77.5–425)	
Oliguria (%)	54	58.6	0.73
ATNISS	0.69	0.68	0.43
	(0.6–0.78)	(0.42–0.77)	
ICU (%)	73.3	81.7	0.38
APACHE II	26.9±8.9	24.1±8.2	0.13
Mechanical ventilation (%)	68	75	0.54
Hemodynamically unstable (%)	61	63	0.84
N session	5.5	7.5	0.022
	(4–9.5)	(5–14)	
BUN before (mg/dL)	116.4±33.6	112.6±36.8	0.78
Creatinine before (mg/dL)	5.85±1.9	5.95±1.4	0.71
Main comorbidities (%)			
Sepsis	42	47	0.71
Cardiopathy	25	22	0.58
Post surgery	11	16	0.55

Pd versus dHd

	Group 1 CPD	Group 2 Daily HD	<i>p</i> Value
Kt/V per session			
Prescribed	0.65	1.2	
Delivered	0.53	0.79	<0.01
Kt/V weekly			
Prescribed	4.5	7.2	
Delivered	3.51	4.8	<0.01
UF (L/session)	2.1 ± 0.7	2.4 ± 0.72	0.39

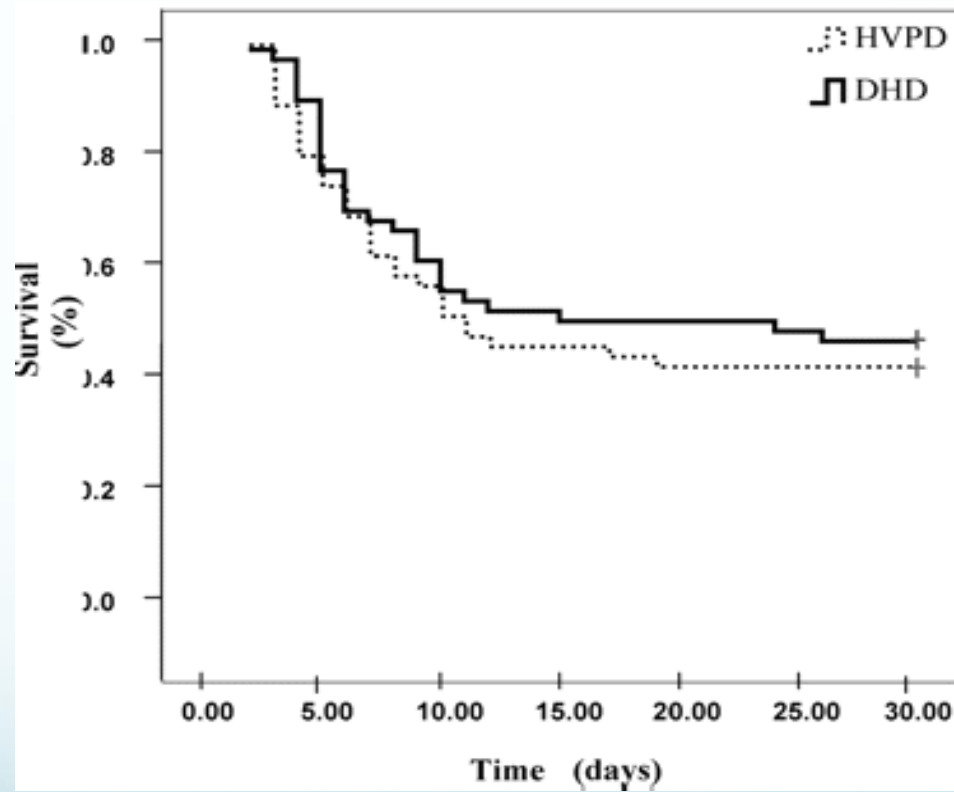
PD versus dHd



PD versus dHd

	CPD	Daily HD	<i>p</i> Value
Complications (%)			
Infectious	18	8.5	0.21
Mechanical	5	13	0.13
Outcome (% total)			
Mortality rate	58	53	0.48
Recovery	28	35	0.84
No recovery	7	10	0.45
Change of method	7	2	0.36

PD versus dHd



PD versus CVVDHF

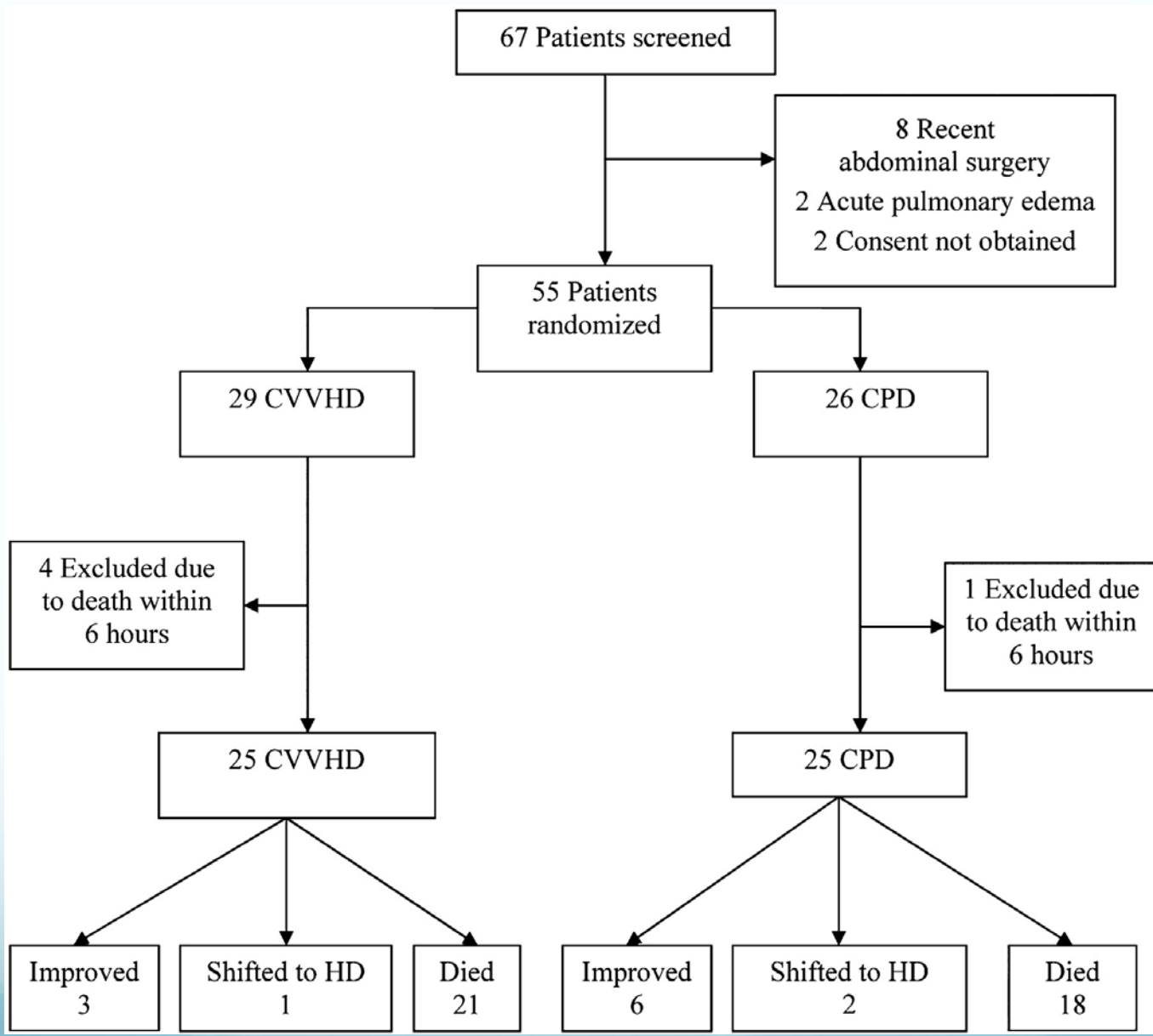
- Pisharody et al India PDI 2011 – pilot study
- Open Prospective randomized study in ICU starting June 2005 over 3 years in South India
- Planned to enroll nearly 200 patients but only managed 50

PD versus CVVHDF

- AKI creatinine increase of 0.3 mg/dl (26 mmol) or urine output less than 0.5ml/kg
- Indications for RRT
 - BUN >150
 - Creatinine >3
 - K > 6
 - pH < 7.2

PD versus CVVHDF

- Patients Randomized to:
- Group A: CVVHDF
- Group B: continuous PD – stiff catheter 1-2 L exchanges manually
- Exclusion recent abdominal surgery of life threatening pulmonary edema
- Death within 6 hours on RRT were excluded from analysis



PD versus CVVHDF

TABLE 1
Baseline Patient Characteristics

Variable	Group		<i>p</i> Value
	HDF	CPD	
Patients	25	25	
Mean age (years) ^a	45.32±17.53	48.44±17.64	NS
Sex (male:female) ^b	15:10	16:9	NS
Time to initiate dialysis after initial consultation (hours) ^c			
Mean	9.94±6.378	17.29±15.90	NS
Median	8.00	8.00	
Interquartile range	5	23.62	
Cause of renal failure (<i>n</i>) ^b			
Sepsis	12	7	NS
Pre-renal/ATN	10	7	
Leptospirosis	1	4	
Snakebite	0	3	
Postoperative	2	4	
Organ involvement ^b			
Three	7	11	NS
Four	10	8	
Five	8	6	
APACHE II score ^c			
Mean	18.44±5.96	17.76±6.79	NS
Median	18	19	
Interquartile range	7	13	
Serum creatinine at onset (mg/dL) ^{a,d}	4.96±1.49	4.69±1.7	NS
Inotropic support (<i>n</i>) ^b	22	22	NS
Ventilatory support (<i>n</i>) ^b	22	15	NS
Mean Glasgow coma scale score ^a	5.08±2.7	5.04±3.1	NS

HDF = hemodiafiltration; CPD = continuous peritoneal dialysis; NS = nonsignificant; ATN = acute tubular necrosis; APACHE II = Acute Physiology and Chronic Health Evaluation II.

^a Student t-test.

^b Chi-square test.

^c Mann-Whitney U-test.

^d To convert serum creatinine in milligrams per deciliter to moles per liter, multiply by 88.4.

TABLE 2
Outcomes of Dialysis

Variable	HDF	Group CPD	<i>p</i> Value
Patients	25	25	
Duration of dialysis (hours) ^a			
Mean	21.68±13.46	66.02±69.77	0.01
Median	20	48	
Interquartile range	19	74.5	
Ultrafiltration volume (L) ^a			
Mean	20.31±21.86	5.31±5.75	<0.001
Median	17.1	2.8	
Interquartile range	22.25	1.04	
Net ultrafiltration (L) ^a			
Mean	2.9±2.4	2.8±4.1	NS
Median	2.3	1.6	
Interquartile range	3.43	4.13	
Composite correction of metabolic parameters and fluid overload (<i>n</i>) ^b	12	14	NS
Urea clearance (mL/min) ^a			
Mean	21.72±10.41	9.36±4.93	<0.001
Median	19.62	9.58	
Interquartile range	10.67	8.43	
Creatinine clearance (mL/min) ^a			
Mean	22.13±9.61	10.5±6.07	<0.001
Median	20.79	9.97	
Interquartile range	10.4	10.04	
Correction of			
Uremia (<i>n</i>) ^b	16	12	NS
Acidosis (<i>n/N</i>) ^b	5/21	14/16	<0.001
Fluid overload (<i>n/N</i>) ^c	16/17	12/14	NS
Hemodynamic disturbances (<i>n/N</i>) ^b	5/25	9/16	NS
Altered sensorium (<i>n/N</i>) ^c	2/16	5/13	NS
Hyperkalemia (<i>n/N</i>) ^c	2/4	2/5	NS
Time to correct			
Uremia, complete or partial (hours) ^a			
Mean	18.56±13.74	28.83±31.29	NS
Median	14.5	14.0	
Interquartile range	9.5	38	
Acidosis, complete or partial (hours) ^a			
Mean	6.0±0	12.71±6.91	NS
Median	6	12	
Interquartile range	0	12	
Fluid overload (hours) ^a			
Mean	3.35±1.64	10.58±7.04	<0.001
Median	3.0	9.0	
Interquartile range	2	85	

HDF = hemodiafiltration; CPD = continuous peritoneal dialysis; NS = nonsignificant.

^a Mann-Whitney U-test.

^b Chi-square test.

^c Fisher exact test.

Summary

- PD is viable in AKI
- If PD works in those very acute settings then why not for urgent starts
 - These patients are less acute and should get adequate metabolic correction with PD
 - PD must become the default therapy with a change in mindset for this to work
 - Dedicated space and time for PD

Summary

- Prescription Options
 - IPD 1-2L exchanges with short dwells (1 hour)
 - 16-24 hours per treatment ; 2-3 times per week
 - Clearance at 40-60L per session ; 80-180L per week
 - CAPD
 - Exchanges q 3-6 hours
 - Simple

Summary

- Volume management
 - For an average transporter q 1h exchanges with 2 L exchanges

Glucose []	UF per hour	Glucose Absorbed
1.5	50-150ml	27.2 grams
2.5	100-300ml	45.4 grams
4.25	400+ml	80 grams