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Are outcomes on APD superior to those on CAPD?

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Conflict of Interest

I have/had an affiliation (financial or otherwise) with a pharmaceutical, medical device or communications organization.

No

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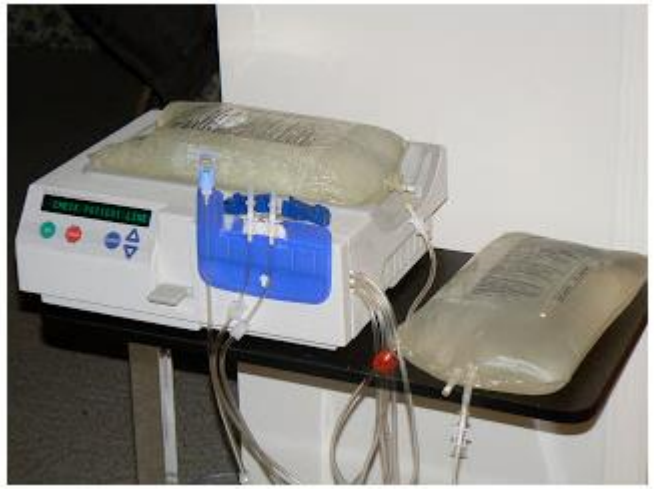
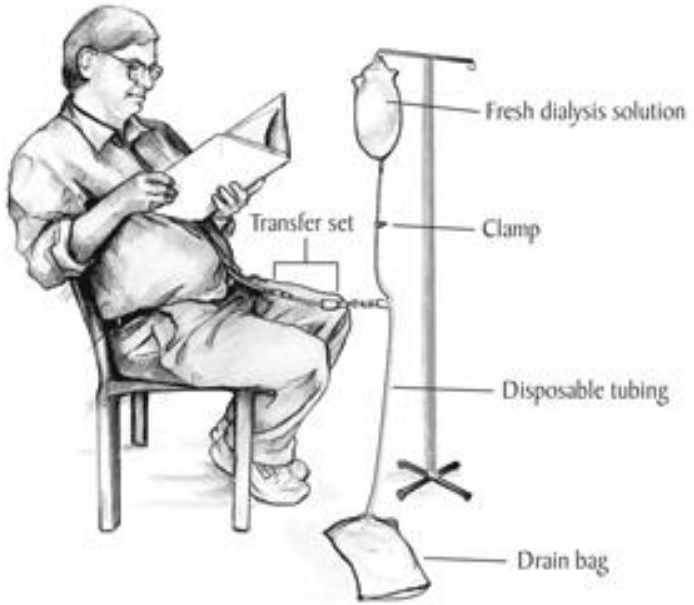
Background: APD and CAPD





http://justkidneying.blogspot.com, www.homedialysis.org

Differences

- APD
  - Cycling of fluid typically done at night while sleeping
  - Can be done with dry day (NIPD) or with last fill or daytime exchanges
  - Slightly more complicated to learn than CAPD
  - Requires electricity
  - Can be complicated by mechanical failures
  - Less connections – opening of catheter
  - More expensive
- CAPD
  - Manual peritoneal dialysis
  - Typically done continuously, 4 exchanges a day
  - More simple procedure
  - More connections – opening of catheter
  - Less expensive

Audience Response Question

- Are outcomes on APD superior to those on CAPD?
  - Yes
  - No
  - They are the same
  - I don’t know

https://manage.eventmobi.com/en/ars/results/question/14514/377875/486c267d7193f52b54bf1a9f26f61ff6/

Is one superior to the other?

- Patient interest
  - How long will it take to do?
  - How hard is it to learn, I am worried I will mess it up!
  - How will this therapy affect work, family, friends, social life?
  - Will I feel better if I choose one over the other?
  - Will I be able to sleep?
- Physician Interest
  - Residual Renal function
  - Peritonitis risk
  - Volume management
  - Technique survival
  - Mortality
- Payer Interest
  - How much does it cost?
  - Am I getting a good value for the treatment provided?
  - Is the therapy provided quality? (what is the Kt/V?)

Focus today on outcomes:

- Residual renal function
- Peritonitis risk
- Volume management
- Technique survival
- Mortality
- Health related quality of life
- Note: This is very difficult to study, randomization and recruitment difficult, observations can be confounded in many ways: indication for therapy, patient/membrane characteristics, provider factors, RAAS blockade, APD is delivered in many different fashions

Residual Renal Function (RRF)

- Greater RRF = Lower Mortality
- Rapid loss of RRF after starting PD = Greater Mortality Risk

- Therefore, we want to choose the therapy that is best at preserving RRF or delays decline in RRF

- Difference in fluid removal with APD and CAPD may impact RRF
  - APD fluid removal predominantly at night
  - CAPD more gradual over 24 hours

Selected Studies of PD and RRF

First Author (year)	Study type	Period / Country	Data source	Sample size (CAPD, APD)	Follow-up duration	Measure of GFR	Outcome
De Fijter (1994)	Randomized controlled trial	1988-1991 Netherlands	Single center	82 (41, 41)	24 mo	24 hr urine CrCl ml/min/1.73 m^2	No significant difference in change in the two groups (CAPD: 4.0 to 2.8 ml/min/1.73 m^2; APD, 5.4 to 2.1 ml/min/1.73 m^2)
Bro (1999)	Randomized controlled trial	1995-1999 Denmark	Multicenter	34 (17,17)	6 mo	24 hr urine CrCl ml/min	No significant difference in decline in residual kidney function; mean clearances at end of six months: APD, 3.0 ml/min, CAPD, 3.5 ml/min
Moist (2000)	National Registry Data	1997 United States	Dialysis Morbidity and Mortality Wave 2 Study of United States Renal Data System	1032 (722, 310)	8-18mo	Time to Anuria (<200ml/24hrs)	No significant difference in time to anuria in individuals treated with CAPD and APD
Michels (2011)	Prospective cohort study	1997-2006 Netherlands	The Netherlands Cooperative Study on the Adequacy of Dialysis (NECOSAD)	583 (505, 78)	3 mo-3 yr	Mean of 24 hr urine urea and creatinine clearances ml/min/1.73m^2	No significant difference in the rate of decline of kidney function in individuals treated with CAPD or APD. Individuals started on APD had a 2 times higher risk of achieving anuria in the first year compared with CAPD

RRF and PD modality summary

- Studies available are observational or post hoc analysis of RCTs
- Most are small and single center, most not treated with RAAS blockade
- Majority of these studies do not consider the APD prescription and the effect that may have on RRF
- Some reports of a faster decline in RRF with APD but majority do not show a convincing difference
- Evidence that APD leads to more rapid decline in residual kidney function is not persuasive. The difference, if any, is small

Peritonitis Risk

- CAPD and APD differ significantly in the frequency and method of making the connections and disconnections between the PD catheter and dialysate bags.
- Twin bag Y-set systems and flush before fill are now the standard
- Older studies may reflect older methods of spiking the bags which are more prone to infection, method is often not specified in studies

First Author, *et al* (publication year)	Study type	Period / Country	Data source	Sample size (CAPD, APD)	Follow-up duration	Outcome
deFijjter (1994)(18)	Randomized controlled trial	1988-1991 Netherlands	Single center	82 (41, 41)	24 mo	Overall rate (episodes per patient year) was 0.94 for CAPD and 0.54 for APD, difference of 0.43 episodes per patient year (p=0.03). Median time to first episode of peritonitis was 18 months for APD and 11 months for CAPD (p = 0.06)
Bro (1999)(21)	Randomized controlled trial	1995-1999 Denmark	Multicenter	34 (17,17)	6 mo	2 cases of peritonitis in CAPD group and 1 case in APD group
Oo (2005)(31)	National Registry Data	1994-1997 United States	Multicenter	11,975 (9190, 2785)	6mo - 2yrs	Average time to first peritonitis longer with CAPD compared to APD (17.1 vs. 16.1 months (0.70 vs. 0.74 episodes per patient-year, respectively) p= 0.008).
Davenport (2009)(32)	Retrospective Study	2002-2003 United Kingdom	Multicenter	863 (538, 325)	2 yrs	Average number of months between peritonitis episodes 14.7 for CAPD and 18.1 for APD (0.81 vs. 0.66 episodes per patient year, respectively) (p <0.05). Significant variation in peritonitis rates between facilities.
Nessim (2009)(34)	Retrospective study	1996-2005 Canada	Multicenter	3180 (unclear)		No difference in peritonitis rate ratio between CAPD and APD (RR = 1.03, 95% CI 0.91-1.16, p=0.65). CAPD was not associated with shorter time to peritonitis than APD (HR 1.02, 95% CI 0.92-1.13, p= 0.69)
Balasubramanian (2011)(27)	Retrospective Study	2003-2008 United Kingdom	Single center	372 (178, 194)	5 yrs	CAPD peritonitis rate 1:29 patient months, APD peritonitis rate 1:37 (0.41 vs. 0.32 episodes per patient-year, respectively). Odds ratio 0.78 in favor of APD (95% CI 0.63-0.98).
Ruger (2011)(35)	Retrospective Study	1993-2007 Netherlands	Single center	205 (112, 93)	Review of all cases of peritonitis, 14yr period	Peritonitis frequency in CAPD 1:18.6 patient months and 1:19.4 patient months in APD (0.65 vs. 0.62 episodes per patient-year respectively); difference not statistically significant)

Peritonitis Risk Summary

- Perhaps slightly greater risk of peritonitis with CAPD in older cohorts, may be explained by the differences in connection systems. Newer studies suggest no significant difference
- No studies comparing the severity, response, relapse, and recurrence rates of peritonitis in patients treated with CAPD and APD; this should be a focus of future investigations
- Data for outcomes with continuous or intermittent dosing of antibiotics presently are insufficient, particularly for patients undergoing APD

Volume Management

- Short, frequent dwells can lead to sodium sieving
- With longer dwells sodium concentration in dialysate approaches serum levels
- Could management of sodium balance and ECV excess be easier achieved with longer dwells seen on CAPD?

First Author, *et al* (publication year)	Study type	Period / Country	Data source	Sample size (CAPD, APD)	Follow-up duration	Outcome
deFiijter (1994)	Randomized controlled trial	1988-1991 Netherlands	Single center	82 (41, 41)	24 mo	No difference in mean arterial pressure or mean dry weight over time. Antihypertensive meds were used in 60% of individuals undergoing and 74% undergoing APD
Bro (1999)	Randomized controlled trial	1995-1999 Denmark	Multicenter	34 (17,17)	6 mo	No episodes of weight > 2kg above dry weight in CAPD group, 2 cases in APD group. Mean systolic blood pressure similar in both groups.
Rodriguez-Carmona (2004)	Prospective cohort study	1998-2002 Spain	Single center	104 (53, 51)	12-24 mo	Ultrafiltration and sodium removal rates were consistently and significantly lower in APD group. Better control of systolic blood pressure in CAPD group
Bavbek (2007)	Cross-Sectional Study	2007 Turkey	Two centers	62 (32, 30)	-	APD group with significantly lower daily ultrafiltration volume, higher serum brain natriuretic peptide, and left ventricular mass index but no significant difference in blood pressure, compared to CAPD group.
Davison (2009)	Cross-Sectional Study	2004-2006 Canada	Single Center	158 (90, 68)	-	No significant difference in sodium removal, ultrafiltration or blood pressure between groups. Liberal use of icodextrin, limited number of nocturnal exchanges and supplemental daytime exchange in APD group
Van Biesen (2011)	Cross-Sectional Study	Europe	Multicenter	661 (53% APD)		Individuals without access to icodextrin were excluded. PD modality was not associated with extracellular volume excess as measured by bioimpedance.
Cnossen (2012)	Cross-Sectional Study	Netherlands	Multicenter	44 (24, 20)	~21-30 mo	Total sodium removal lower in APD compared with CAPD but no statistically significant difference in systolic blood pressure, ultrafiltration volumes, or brain natriuretic peptide UF

Volume Management Summary

- Flush volume often not accounted for, predicted to be higher in CAPD so may account for higher sodium removal seen with CAPD in studies
- APD prescriptions are heterogeneous: prescriptions with longer dwell times, diurnal exchanges, and icodextrin for long diurnal dwells are associated with significantly higher sodium and water removal
- Little difference in the achievement of dry weight or blood pressure control between the 2 modalities
- Volume management requires individualized approach

Technique Survival

- When patients transfer from PD to HD → Technique Failure
- With the right resources technique failure can be avoided
- Provider practice patterns complicate technique survival studies, including those comparing CAPD to APD

- Could APD be a less burdensome therapy leading to greater patient retention on PD?

Mortality

- Attributing differences in mortality to any therapy is difficult and confounded by measured and unmeasured patient- and facility-specific factors.
- Two potential causal physiologic mechanisms may be differentially affected by the 2 PD sub-modalities:
  - Residual kidney function and
  - Serum albumin level

Mortality

- Majority of available large observational studies have not reported differences in mortality
- Exceptions:
  - One single-center study revealed a lower death risk in patients younger than 65 years who were treated with APD, whereas elderly patients had similar outcomes on CAPD and APD.
  - A single-center study from Mexico reported lower mortality for individuals treated with APD, particularly in the first year of dialysis.
  - In an analysis of the Australian and New Zealand dialysis registry, there was lower death risk in fast or high transporters treated with APD compared with CAPD, but higher death risk in slow or low transporters.

First Author, *et al* (publication year)	Study type	Period / Country	Data source	Sample size (CAPD, APD)	Follow-up duration	Outcome
deFijter (1994)	Randomized controlled trial	1988-1991 Netherlands	Single center	82 (41, 41)	24 mo	No significant difference in technique survival or all-cause mortality.
Mujais (2006)	*Post-hoc* analysis of prospectively collected data	2000-2003 United States	Multicenter Baxter Healthcare Corporation On-Call™ system	40,869		Better technique survival in APD (mostly concentrated in the first year of therapy); no difference in all-cause mortality
Badve (2008)	National Registry Data	1999-2004 Australia and New Zealand	Multicenter Australia and New Zealand Dialysis and Transplant (ANZDATA)	4128 (2393, 1735)	5 yr	No significant difference in technique survival or all-cause mortality
Sanchez (2008)	Retrospective Study	2003-2005 Mexico	Single center	237 (139, 98)	2 yr	Technique survival significantly better and all-cause mortality lower in individuals undergoing APD
Mehrotra (2009)	National Registry Data	1996-2004 United States	Multicenter United States Renal Disease System (USRDS)	66381 (42942, 23439)	2-10 yrs	No significant difference in technique survival or all-cause mortality
Michels (2009)	Retrospective Study	1997-2006 Netherlands	Multicenter The Netherlands Cooperative Study on the Adequacy of Dialysis (NECOSAD)	649 (562, 87)	5 yr	No significant difference in technique survival or all-cause mortality
Johnson (2010)	National Registry Data	1999-2004 Australia and New Zealand	Multicenter Australia and New Zealand Dialysis and Transplant (ANZDATA) Registry	High transporters (142, 486) Low transporters (n=196)	3mo - 10yrs	Compared APD vs. CAPD in high transporters and APD vs. CAPD in low transporters. No significant difference in technique survival between groups; Lower death risk in high transporters treated with APD and higher death risk in low transporters treated with APD
Sun (2011)	Retrospective Study	1997-2008 Taiwan	Single center	282 (121, 161)	3mo - 10yrs	Technique survival higher in APD group and lower all-cause mortality in APD group as a whole. For individuals older than 65 APD was associated with higher mortality.

Technique Survival / Mortality Summary

- Reasons for transitioning from PD to HD are numerous and more often related to factors outside the PD modality. Available evidence has not shown a meaningful difference in technique survival by PD modality
- PD modality is not likely to be an important determinant of death risk for the majority of PD patients.

Quality of Life

First Author, *et al* (publication year)	Study type	Period / Country	Data source	Sample size (CAPD, APD)	Follow-up duration	Outcome
Bro (1999)(21)	Randomized controlled trial	1995-1999 Denmark	Multicenter	34 (17,17)	6 mo	Significantly more time for work, family and social activities but greater problem with sleep disturbances in APD group.
de Wit (2001)(57)	Cross Sectional Study	1993-2001 Netherlands	Multicenter The Netherlands Cooperative Study on the Adequacy of Dialysis (NECOSAD)	(59, 37)		Mental health better in in APD group: less depression and anxiety. No difference in physical functioning.
Sunder (2008)(58)	Prospective Observational (fixed crossover design)	India	Single center	18 (all high or high average transporters)	All indivduals underwent 6 mo CAPD followed by 6 mo APD	No significant difference in parameters of physical or mental quality of life.
Guney (2010)(59)	Cross Sectional Study	Turkey	Single center	(48, 20)		No significant difference in health-related quality of life, sleep quality, or depression.
Balasubramanian (2011)(27)	Retrospective Study	2003-2008 United Kingdom	Single center	372 (178, 194)	5 yrs	No significant difference in health status, physical or mental health scores by SF-36 questionnaire.
Michels (2011)(29)	Prospective cohort study	1997-2006 Netherlands	The Netherlands Cooperative Study on the Adequacy of Dialysis (NECOSAD)	(486, 64)	3 mo-3 yr	No significant differences in quality of life scores between groups.

Conclusions

- There are no compelling evidence to suggest that one PD modality is superior to the other with regards to residual renal function, peritonitis risk, volume management, technique survival, mortality or health related quality of life
- In light of this, the best course when determining PD modality is a process that includes extensive education of the treatment options available, cost considerations and shared decision making between providers and patients
- Patient preference and lifestyle considerations should be at the forefront of decision making