Peritoneal Dialysis in Special Populations

ISPD-NAC Curriculum
2011

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Kidney Replacement Therapy: Modality Choice

- Many patients have a medical contraindication for transplantation
- Far fewer patients have an absolute medical contraindication for one dialysis therapy over the other
- The majority of patients could do either
- Patient preference should play an important role in the choice of dialysis modality

Most Patients Are Eligible for PD

>1000 ESRD Patients Starting Dialysis

	% Medically Eligible for PD
Netherlands[1]	83%
U.S.[2]	76%
U.K.[3]	76%

1. Jager K et al. *Am J Kidney Dis.* 2004;43:891-899.
2. Mehrotra et al. *Kidney Int.* 2005;68:378-390.
3. Little et al. *Am J Kidney Dis.* 2001:37:981-986

[1] Most patients are medically eligible for PD. PD has few absolute medical contraindications. In a large Dutch study, only 17% of ESRD patients had a medical contraindication to PD; the most common was previous major abdominal surgery. Many patients in this study had a social contraindication to PD, the most common was an inability to perform PD exchanges by themselves. In a recent U.S. study, only 23% of ESRD patients had a medical contraindication to PD, this was consistent with the 17% to 21% seen in studies from other countries. (Jager KJ et al. Am J Kidney Dis. 2004;43:891-899).

[2] At the start of dialysis therapy, the patient's nephrologist completed a structured questionnaire on the process of long-term modality selection (Appendix). Although modality choice most often is based on several grounds, the nephrologist was asked what he or she considered the most important reason for the selection of a particular modality (Mehrotra R, et al. Kidney Int. 2005;68:378-390)

Peritoneal Dialysis in Special Populations: Outline:

- Elderly populations
- Diabetics
- Obesity
- Polycystic kidney disease
- Patients with a history of multiple previous abdominal surgeries
- Cirrhosis and chronic ascites

Peritoneal Dialysis in the Elderly

Special Considerations in Geriatric Nephrology

- Quality vs. quantity of life: quality may be more important to the geriatric patient
  - Avoiding hospitalizations, complications
  - Prefer more time at home with family/friends/hobbies
- Accumulation of comorbidities occurs with age in all patient groups, and affects survival data regardless of RRT modality
- Few studies specifically address this age group

Potential advantages of PD in the elderly

- Increased cardiovascular stability (fewer arrhythmias)
- Fewer travel requirements to and from center
- Avoidance of repeated vascular access
  - elderly often have poor target veins, require repetitive vascular procedures
  - avoids chronic venous catheters when AVF/G are unsuccessful
- Low risk of GI bleeding (no anticoagulation)
- Conducive to recreational travel
- Excellent 1-year survival

Patients not normally considered for PD may have reasons to choose this modality

PD in the elderly: potential problems

- Increased number and complexity of comorbidities in older patients
- Depression, dementia, impaired vision, and decreased physical and mental activity may impair self-performance of dialysis procedures.

Dimkovica N. and Oreopoulos DG, Perit Dial Int 20:276-283, 2000

Specific factors affecting PD in elderly

Advanced age

- Decreased manual dexterity/chronic arthritis
- Inability to ambulate/transfer
- Incapable of performing PD exchanges themselves
- Lack of social support

Manual dexterity problems: potential solutions

- Connection assist devices
- Cycler

Manual dexterity problems- potential solutions

- Adaptive CAPD systems

Rotary disc-system for CAPD

Assisted PD in the elderly

- Social or medical factors can be barriers to self-care dialysis
  - Leading to underutilization of PD in the elderly
- Home care assistance can allow more patients to receive PD at home
- Some patients start w/ assisted PD then “graduate” to self-care PD

Various models of assisted-PD

- Family or friend trained as an assistant
- Automated PD (APD) with two daily nurse visits
  - AM and PM visits to disconnect and connect from cycler, respectively
  - Allows one RN to attend to more than one patient per day
- APD or CAPD with a home health assistant
- Employment and training of a dedicated care-giver
- Assisted living center or Skilled Nurse Facility

Assisted-PD: data

- Healthcare policies supporting assisted PD increase utilization of PD[1]
  - Specific funding is available and has been studied in: Belgium, Canada, Denmark, France and Canary Islands
- Assisted PD does not cost more than in-center HD, even when the cost of the home care provider is taken into account[2]

1. Increased utilization of home dialysis, especially in the elderly population, occurred in Canada and also in several European countries after the adoption of formal assisted home dialysis programs.
2. Despite the additional costs of providing caregivers, these assisted Peritoneal Dialysis programs reported cost savings with PD (as compared to in-center HD) that persisted even after taking into account payments to home care providers; these cost savings were realized because PD itself provides cost savings over chronic hemodialysis of almost $20,000 per patient per year.

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-Oliver MJ, Quinn RR, Richardson EP, Kiss AJ, Lamping DL, Manns BJ. Home care assistance and the utilization of peritoneal dialysis. *Kidney Int.* 71(7):673-678, 2007.
-U.S. Renal Data System. Table D.3 - Counts of incident ESRD patients, by initial mode of therapy: hemodialysis. In: National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, eds. *USRDS 2007 Annual Data Report: Atlas of End-Stage Renal Disease in the United States*. Bethesda, MD; 2007.

Special concerns when using PD in the elderly

- Higher malnutrition risk
  - Decreased appetite, socio-economic factors, and more comorbidities in this group are contributing factors
  - Must pay close attention to diet and nutritional status
- Several studies show infection rates to be similar in elderly vs. non-elderly PD patients, however, infection is associated with greater mortality in the elderly

References
1. Ho-dac-Pannekeet. Nephrol Dial 21 [Suppl 2]: ii60–ii62, 2006
2. Li PK et al. Peritoneal Dialysis International, Vol. 27, Supplement 2, 2007

PD in the elderly: conclusions

- PD is not contraindicated in elderly and offers some advantages over in-center HD
- Home care assistance can allow more elderly ESRD patients to receive PD
- Mortality appears to be related to increased burden of comorbidities with age, rather than due to modality *per se*
- Complication rates between PD and HD in the elderly are similar; peritonitis rates may be somewhat higher in elderly but the reported overall peritonitis rates in elderly are acceptable (less than 1:20 months)

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Peritoneal Dialysis in Diabetics

Diabetics and ESRD

- Among all ESRD patients, diabetics fare among the worst, in part due to their high burden of cardiovascular disease

- PD provides a survival advantage over HD for the 1st two years of therapy,
  - possibly in part due to reduced infection rates (high catheter rate in the first year of HD), and better preserved residual kidney function with PD

Potential advantages of PD in diabetics

- Home-based continuous therapy
- Less dialysis-induced hypotension, coronary ischemia, and arrhythmia; better sustained blood pressure control
- Better preservation of residual renal function
- No need for vascular access
- No systemic heparinization
  - important for patients with significant DM retinopathy and a tendency for retinal hemorrhage
- Less progressive DM retinopathy*

*Sato K, Babazono T.. Clin Dialysis, 2000;16:2137–42.

Potential disadvantages of PD in diabetics

- Glucose absorption from dialysate:
  - Hyperglycemia
  - Weight gain
  - Hypertriglyceridemia
  - Peritoneal membrane changes
    - Exposure to advanced glycosylated end products (AGEs) and glucose degradation products (GDPs)

Neutral effects of dialysis modality in Diabetics

- No consistent evidence exists to show that diabetics have more infections (peritonitis or exit site)
- No consistent evidence exists to prove a higher incidence of EPS in diabetic *vs.* non-diabetics on PD

EPS= encapsulated peritoneal sclerosis

PD in diabetics: outcome studies

- Large disparity in the results of studies evaluating outcomes of diabetics on PD versus HD
  - Some show benefits of one dialysis modality or the other, some show no difference
  - Large heterogeneity in study design, patient background (including age, dialysis vintage, comorbidities) and statistical methods used

General findings of survival studies: PD *v.* HD in diabetics

- Non-diabetics and younger diabetics (18-44y) have superior or equivalent survival rates with PD compared with HD
- In the U.S.A., diabetic ESRD patients > 45y have better survival with HD than PD, whereas in Canada and Denmark, there is no survival difference between PD and HD in this group
- PD offers an equal or lower mortality rate overall compared to HD in the first 1-2 years of dialysis therapy; thereafter the results vary by subgroup
- In addition to DM status, both age and the presence of comorbidities influence the effect of dialysis modality on survival
- More contemporary cohort studies show survival rates are improving in PD whereas they are stagnant in HD

PD is not contraindicated in DM

Vonesh et al. Kidney International (2006) 70, S3–S11

Special considerations for diabetics on PD

Limit glucose absorption as much as possible:
-limit use of hypertonic solutions

-consider Icodextrin for the long dwell, especially in rapid transporters, due to its superior UF efficiency (see next slide)

	Icodextrin	2.5% dextrose	4.25% dextrose
CHO per 2L	150 g	45.5 g	77.2 g
% Absorbed per 8-hour dwell	25%[d]	86%	86%
Approx. g of CHO absorbed per dwell	37.5	39	66
Approximate Kcal/dwell	150	156	266

Gokal R et al. *Kidney International* (2002) **62**, S62–S71

Ultrafiltration Efficiency:

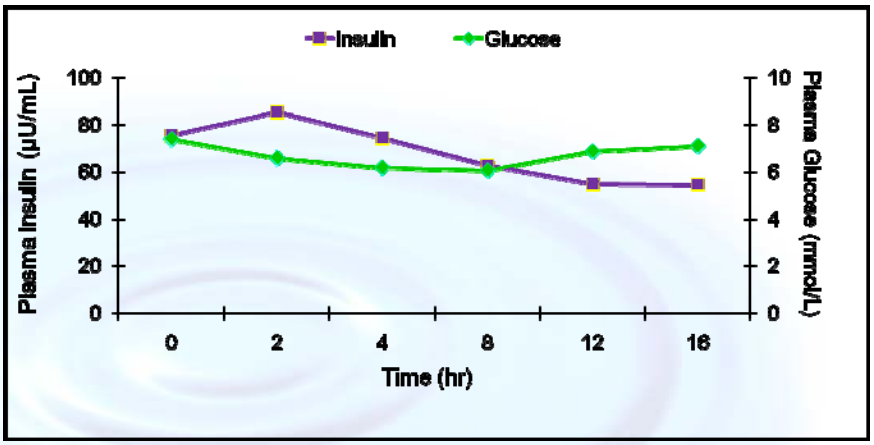
volume of ultrafiltration achieved per gram of carbohydrate absorbed: Icodextrin is more efficient

Comparison of UF efficiency with 2.5% dextrose compared with Icodextrin for the long dwell in CAPD

	Dwell time (hr)	Net UF (ml)	CHO absorbed (gm)	UF efficiency (ml/gm)
2.5%Dextrose	10.1	271	39.3	7.9
Icodextrin	10.6	599	34.6	27.8
p value	0.001	<0.0001	<0.0001	<0.0001

Holmes and Mujais Kid Int 70: S104, 2006

Absence of hyperglycemic and hyperinsulinemic effects when using Icodextrin during the long dwell



Gokal R et al. *Kidney International* (2002) **62**, S62–S71

Improved metabolic control and volume status with Icodextrin

- RCT comparing PD patients receiving either *Icodextrin (ICO)* or *glucose-based* (GLU) PD solution for the long dwell

3 x 2L of 1.5% GLU + 2L ICO (long dwell)	3 x 2L of 1.5% GLU + 2L 2.5% GLU (long dwell)

  - 12 month follow-up
    - Liberal use of 2.5% and 4.25% dextrose solution allowed in both groups in order to meet target BP and edema status
  - Monthly measurements of labs and clinical parameters

Paniagua R. et al. Perit Dial Int 29:422, 2009

•All patients had PET status = high or high average

•Goals of study BP control (BP; <130/80 mmHg) and no clinical edema, through an increment in peritoneal UF

•Dietary Na+ prescribed @ 50mmol/day, set menus given to patients to help them achieve goals

Icodextrin in diabetic PD patients

(Paniagua 29:422-432, 2009)

- Baseline characteristics similar
  - Demographics, labs, renal and dialysis clearance, HgbA1c, vintage, PET status, comorbidities
- Weight gain seen with GLU but not ICO
- ICO associated with decreased fasting serum glucose, glycated Hgb, triglycerides, and insulin requirement
- Fewer adverse events in ICO than GLU

Strategies to improve outcomes for diabetics on PD: conclusions

- Avoidance of hypertonic dialysate
- Use of Icodextrin
- Maintain HgbA1C < 7.5% (theoretical)
- Maintain euvolemia and effective UF
- Encourage exercise and maintenance of appropriate body weight
- Screen and treat for non-renal DM complications
- Possibly: use of biocompatible dialysate* (study in progress)

* IMPENDIA trial
"Multi-center,Prospective, Randomized Trial To Demonstrate Improved Metabolic Control of PEN VS Dianeal In Diabetic CAPD and APD Patients - The Impendia Trial"

Primary Objective: To demonstrate that use of glucose sparing prescriptions (PEN vs Dianeal) in diabetic (Type 1 and Type 2) Continuous Ambulatory Peritoneal Dialysis (CAPD)and Automated Peritoneal Dialysis (APD) patients leads to improved metabolic control as measured by the magnitude of change from the baseline value in the HbA1c levels. [PEN=physioneal, extraneal, nutrineal]
Secondary Objectives: To demonstrate that use of glucose-sparing PD solutions (PEN vs Dianeal) in diabetic (Type 1 and Type 2) CAPD and APD patients leads to lower glycemic-control medication requirements, decreased incidence of severe hypoglycemic events requiring medical intervention, improved metabolic control, nutritional status, and Quality of Life. In a subgroup of patients, the impact of glucose-sparing PD solutions (PEN vs Dianeal only) on abdominal fat and left ventricular (LV) structure and function will be assessed.

See: http://clinicaltrials.gov/ct2/show/NCT00567489

Obesity and Peritoneal Dialysis

Obesity and PD

Obese patients with ESRD are less likely to initiate PD in the U.S.[1]

Why?

- Misconceptions re: outcomes of PD in obese patients
- Obese patients are not offered PD
- Clinicians inexperienced and thus less comfortable with management of PD in obese patients

1. Snyder et al. Kidney International, Vol. 64 (2003), pp. 1838–1844
-Obese subjects were less likely to initiate peritoneal dialysis, less likely to undergo transplantation, and more likely to switch to hemodialysis, but had better survival than those with lower BMI.

BMI and dialysis

- Low BMI (<22) is associated with increased risk of death, regardless of RRT modality
- Obesity (BMI >30) may confer a survival *advantage* in ESRD
  - in contrast to its negative effects in the non-CKD population

n.b. it is important to distinguish if the patient has a high BMI due to increased fat mass vs. muscle mass

References:

-Abbott KC, et al. Kidney International, Vol. 65 (2004), pp. 597–605

-Johnson DW, Herzig KA, PurdieDM, *et al: Is obesity a favorable* prognostic factor in peritoneal dialysis patients? *Perit Dial Int* 20:715–721, 2000

-Aslam N, Bernardini J, Fried L, *et al: Large body mass index* does not predict short-term survival in peritoneal dialysis patients. *Perit Dial Int 22:191–196, 2002*

BMI and dialysis, continued

- Obesity may confer a survival advantage in dialysis patients
  - this survival benefit may be more pronounced with HD than with PD, however, BMI > 30 is *not associated* with worse survival (than normal BMI) in PD patients
  - No strong evidence exists that mortality significantly differs between obese patients on peritoneal dialysis vs. obese patients on hemodialysis

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Obesity and PD: concerns and potential clinical problems

- Catheter leak, exit site infections, peritonitis
- Patients with high BMI may have inadequate solute clearance or ultrafiltration

Obesity and PD: Potential clinical problems

Problem: catheter leak, exit site infections, peritonitis

– Solutions:

→plan catheter placement in advance (pre-operative catheter measurements)

→avoid midline incision site (use paramedian)

→avoid pannus region for exit site

→ensure patient can see exit site, placing it higher up on abdominal wall

→use pre-sternal catheters if needed

Obesity and PD: Potential clinical problems

– Catheter leak, exit site infections, peritonitis

Problem: patients with high BMI may have inadequate solute clearance or ultrafiltration?

Solutions:

→use larger fill volumes (2500 – 3000 mL)

→use CCPD

→monitor residual kidney function (RKF) often and consider planning for transition to HD as RKF is lost

Feasibility of adequate solute clearance in obese PD patients

- Prospective, cross-sectional study in an urban hospital
- 58 patients studied, including 10 anuric obese patients

	BMI ≥ 29 (obese)	TBW ≥ 48 L (large frame)	BMI < 29 (nonobese)
No. of pts	25	10	33
Weekly Kt/V	2.49 ± 0.33	2.33 ± 0.40	2.28 ± 0.35
Met Kt/V target*	84 (63.9-95.5)	60 (26.6-90.4)	63.6 (45.1-79.6)
BMI	35.5 ± 4.8	35.6 ± 6.2	24.1 ± 2.7

**Proportion of patients who achieved Kt/V urea target by DOQI guidelines (Kt/V urea 2.0 in CAPD and 2.1 in CCPD).*

Shibagaki Y. et al. *Am J Kidney Dis* 40:1295-1300.

Obese patients on PD were able to achieve weekly Kt/V targets
BMI=body mass index; TBW=total body water; Kt/V=Kt/V urea

Feasibility of adequate ultrafiltration in obese PD patients – anuric and non-anuric

	BMI ≥ 29	BMI < 29	BMI ≥ 29 anuric	BMI < 29 anuric
No. pts	25	33	10	10
CCPD (%)	64.0	48.5	60.0	40.0
Dwell vol (L/d)	14.6 ± 4.4	11.9 ± 3.1	16.5 ± 3.5	13.8 ± 2.8
Drain vol (L/d)	16.0 ± 4.9	12.8 ± 3.1	18.3 ± 4.0	14.5 ± 2.8

Shibagaki Y. et al. *Am J Kidney Dis* 40:1295-1300.

1. CCPD= continuous cycling peritoneal dialysis
2. Note the increased dwell volumes in the obese group – and increased use of CCPD;
3. caveat - Do not know how many were on hypertonic solution.

PD and obesity - conclusions

- Obesity is not an absolute contraindication to PD
- PD in obese individuals
  - does require larger dwell volumes
  - may become more difficult once pt is anuric, and one must evaluate the patient often, adjusting PD prescription accordingly
- Survival studies of peritoneal dialysis in obese patients are inconclusive
  - Due to selection bias, nutritional factors, heterogeneity of studies

-Observational Data suggests differences in the relationship between BMI and Obesity in PD v. HD patients;
-Prospective data has shown that PD patients with high BMI do as well as those with normal BMI (but low BMI patients fare worse than both aforementioned groups).

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Polycystic Kidney Disease and Peritoneal Dialysis

PKD and PD

- Potential problems
  - Decreased intraperitoneal space – decreased effective peritoneal surface area
  - Increased intraabdominal pressure – risk of hernia, leaks
  - Theoretical risk of peritonitis due to presence of colonic diverticuli

PKD and PD: peritonitis

- Limited number of studies, but none have shown any increase in peritonitis rate in patients with PKD compared to those without PKD
- Incidence of gram negative peritonitis not shown to be higher in presence of PKD

References
1.Nolph KD et al. *Kidney Int* 28:198–205, 1985
2.Hadimeri H. et al. *Perit Dial Int* 18: 429-432, 1998
3.Pandya BK et al. *Perit. Dial. Int*. 2004 24: 79-81

PKD and PD: outcomes

- Few studies have been published
- 2 larger trials examining outcomes
  - no difference in ability to achieve solute clearance targets
  - No significant difference in UF achieved
  - No difference in outcomes

Hadimeri H. et al. *Perit Dial Int* 18: 429-42, 1998
Kumar S. et al. *Kidney Int* 74: 946-951, 2008

PKD and PD outcome: Hadimeri et al. 1998

- retrospective analysis of 26 ADPKD patients on PD vs. 26 controls in a Swedish center
- 4/26 hernias in ADPKD *vs.* 2/26 in controls (P=NS)
- one patient in each group required temporary HD
  - but no ADPKD pt required a permanent change to HD
- Voluminous kidneys did not prevent PD in any patient
- 2 pts had nephrectomy as a pre-transplant measure
  - This may have facilitated PD, but not is recommended routinely because residual kidney function is important to maintain)

Hadimeri H. et al. *Perit Dial Int* 18: 429-432, 1998
-CAPD treatment was not prevented by voluminous kidneys in any of the 38 patients, however, 2 patients were nephrectomized to make room for a transplant which may have facilitated CAPD treatment. No patient ceased PD treatment due to insufficient peritoneal space.

PKD and PD outcomes-
Kumar et al. 2009

- Retrospective analysis of 56 consecutive PKD patients who initiated PD at a single center in London 1994 – 2005
- PKD group matched to a similar PD group (nondiabetic patients with bilateral small kidneys matched for age, sex, and year of ESRD)
- No difference at baseline between the groups
  - Similar: demographics, transport status, measured renal and dialysis clearance, dialysis labs

Kumar S. et al. *Kidney Int* 74: 946-951, 2008

PD outcome in 56 PKD vs. 56 matched non-PKD patients: Kumar et al. 2008

	PKD	Control	p
Death*	7 (12%)	5 (9%)	NS
transplantation	22 (39%)	21 (37%)	NS
Technique failure	17 (30%)	14 (25%)	NS
-peritonitis	8	9	
-leak	3	1	
-patient choice	3	2	
-irreducible hernia**d	1	0	
-bilateral nephrectomy	1	0	

*Two patients died of aneurysmal intracerebral bleed.
**Four patients required umblical hernia surgery repair; however, only one had irreducible umbilical hernia, resulting in permanent cessation of PD.

PKD and PD: conclusions

- Cystic kidneys do not preclude PD
- Avoid excess intra-abdominal pressure as much as possible
  - Use larger fill volumes at night (supine)
  - Ensure proper PD catheter placement with a paramedian incision to prevent leaks and hernias
- “prophylactic” nephrectomy is not generally indicated, and may be harmful (eliminates the benefits of any residual kidney function)

Previous abdominal surgeries and PD

Previous abdominal surgeries and PD

Potential problem:

- Previous abdominal surgeries lead to adhesions or incisional hernias, which in turn cause PD catheter malfunction due to
  - Catheter kinking
  - Catheter migration or malposition
  - Peritoneal compartments with fluid loculation
  - Catheter entrapment or obstruction
  - Catheter leaking

History of previous abdominal surgery does not necessarily predict outcome on PD

- Adhesion or hernia formation after abdominal surgery is not predictable
  - There are large inter-individual differences in adhesion formation rate* after surgery
- Adhesions cannot be assessed on physical exam

* Liakakos T. et al. *Dig Surg* **18: 260–273**

History of previous abdominal surgery does not necessarily predict outcome on PD

Retrospective review of all patients undergoing open PD catheter placement from 1/1/99 to 11/4/04 in a single center in Taipei, Taiwan

	Previous abdominal Surgery	No previous abdominal surgery
Catheter malfunction [n (%)]	3 (16.7%)*	13 (12.5%)*
CAPD peritonitis [n (%)]	6 (33.3%)*	30 (28.8%)*
No. patients	18	104

**P* = NS

Chen S-Y *et al. Perit Dial Int* 27: 557–559

1. Mean age did not statistically differ between groups (51.2 v. 49.4, with and without previous abd. Surgery, respectively)
2. Caveats:

a).122 patients total: 18 with previous abdominal surgery (14.8%), lower than reported incidences in other reports – may create selection bias, and an underpowered study?

b). A longer surgery time was reported in the group who had previous abdominal surgery (84.8 ± 20.1 minutes) versus the group without (65.2 ± 17.7 minutes), and the authors did not report if adhesiolysis was performed in these patients (thus causing longer surgery times)

Technical advances in PD catheter placement improves PD outcomes:

Laparoscopic PD catheter placement

- Allows for simultaneous adhesiolysis or omentopexy*
- Allows for real-time evaluation of the peritoneum to assess suitability
- Allows for detection and repair of subclinical abdominal/inguinal hernias at the time of catheter placement, and *before PD begins*
- Has been shown to reduce the catheter malfunction rate (due to adhesions) to less than 3%

1. Crabtree JH and Fishman A. *Am Surg 2005,* 71: 135–143.
2. Draganic B *et al. Aust N Z J Surg 1998,* 68: 735–739.

*Omentopexy = surgical procedure whereby the greater omentum is sutured to a nearby organ; during PD catheter placement, this procedure allows hanging omentum, which can often "wrap" around the PD catheter , to be tacked up and away from the true pelvis and away from the catheter tip.

PD in patients with chronic ascites

Chronic ascites and ESRD

- Causes of ascites in ESRD patients are typically unrelated to the cause of ESRD
  - e.g. cirrhosis due to viral hepatitis, alcoholic liver disease; CHF and congestive hepatopathy

– No prospective clinical trials examine the effect of dialysis modality in cirrhotics w/ESRD

Potential advantages of PD in cirrhotics

- Avoidance of needles and heparinization in patients who may have impaired coagulability
- Avoidance of rapid fluid shifts and acute hypotension, leading to more hemodynamic stability
- Alleviation and prevention of uncomfortable, tense ascites
- Additional calories provided by dialysate

Summary of reported cases of cirrhotic patients on PD

Reference	Patients (n)	Time on PD	Peritonitis rates (episodes/ pt-months)	PD survival
Marcus et al 1992	9	3mo – 8y	1/14.4	6 pts > 18mo
Durand et al 1993	4	2y – 11y	N/A	≥ 2y
Bajo et al 1994	5	8m – 5.5y	1/9 vs. 1/24*	4 pts > 14mo
DeVecchi et al 2002	21	1m – 5 y	1/39 vs. 1/22*	11 pts > 1y

*Cirrhotics *vs.* control

Chaudhary and Khanna. Perit Dial Int 28(2):113-117,2008

-Marcus RG, Messana J, Swartz R. Peritoneal dialysis in endstage renal disease patients with preexisting chronic liver disease and ascites. Am J Med 1992; 93:35–40.
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-Bajo MA, Selgas R, Jimenez C, Del Peso G, Fernandez-Reyes MJ, Dapena F, et al. CAPD for treatment of ESRD patients with ascites secondary to liver cirrhosis. Adv Perit Dial 1994; 10:73–6.
-De Vecchi AF, Colucci P, Salerno F, Scalamonga A, Ponticelli C. Outcome of peritoneal dialysis in chronic renal failure. Am J Kidney Dis 2002; 40:161–8.

DeVecchi *et al.: r*etrospective analysis of
21 cirrhotic + PD *vs.* 41 non-cirrhotic PD

	Cirrhotics	Controls	P
No. of patients	21	41	
Age (y)	58 ± 11	57 ± 11	NS
Gender (M/F)	14/7	28/13	NS
Body weight (kg)	61 ± 10	67 ± 8	<0.01
Karnofsky Index	71 ± 18	88 ± 11	<0.01
SGA (scored 1-3)	1.75 ± 0.75	1.28 ± 0.53	<0.01
Hospitalization rate (days/year)	16.5	15.4	NS
Deaths (n)	7	10	NS
Peritonitis rate (episodes/yr)	0.31	0.53	NS
Discontinuation of PD (n)	6	12	NS
Plasma sodium (mEq/L)	137 ± 4	137 ± 18	NS
Serum albumin (g/dL)	3.1 ± 0.9	4.0 ± 0.4	NS

FROM:
De Vecchi AF, Colucci P, Salerno F, Scalamonga A, Ponticelli C. Outcome of peritoneal dialysis in chronic renal failure. Am J Kidney Dis 2002; 40:161–8.

NOTES:

1.Karnofsky index: Karnofsky Performance Scale Index classifies patients regarding their functional impairment. Lower score=more functional impairment. 100 = no functional impairment

2. Deaths: occuring during f/u period or w/in 2 months of d/c of therapy. Seven cirrhotic patients died an average of 10.7 7.3 months (range, 1 to 27 months) after the beginning of PD therapy. Causes of death were terminal liver failure (n 5), hepatocellular carcinoma (n 1), and peritonitis (n 1). Ten controls died after 43.5 21.8 months (range, 11 to 60 months). Death was caused by cardiovascular complications (n 6), pneumonia (n 1), and cachexia (n 1), and 2 patients died at home for unknown reasons.

Potential disadvantages of PD in cirrhotics

- Inability to perform self-care dialysis due to overall debilitation
  - Does not preclude assisted PD
- ?Infection risk
  - One study showed increased peritonitis in cirrhotics
    - smaller study (n=5) and older(1994), before widespread use of exit-site infection prophylaxis and predating technological advances in PD (e.g. spike-assist devices for cyclers)[5]
  - Two larger (cirrhotic n=21-25) studies showed no increase risk of peritonitis in cirrhotics[1,4]
  - Risks are more likely to be patient-specific
- Protein losses into dialysate
  - Two studies showed that protein losses, while initially high (>30g/day), reduced to <10g/day [1,2]
  - Counter-pressure in peritoneum is theorized to oppose portal pressure, thus reducing ascites formation and limiting albumin losses into peritoneum
  - Serum albumin levels remained stable over time in two studies[1,3]

Chaudhary and Khanna. Perit Dial Int 28(2):113-117,2008

1. De Vecchi AF, Colucci P, Salerno F, Scalamonga A, Ponticelli C. Outcome of peritoneal dialysis in chronic renal failure. Am J Kidney Dis 2002; 40:161–8.
2. Selgas R, Bajo MA, Jimenez C, Sanchez C, Del Peso G, Cacho G, et al. Peritoneal dialysis in liver disorders. Perit Dial Int 1996; 16(Suppl 1):S215–19.
3. Marcus RG, Messana J, Swartz R. Peritoneal dialysis in endstage renal disease patients with preexisting chronic liver disease and ascites. Am J Med 1992; 93:35–40.
4. Chow KM, Szeto CC, Wu AKL, Leung CB, Kwan BCH, Li PKT. Continuous ambulatory peritoneal dialysis in patients with hepatitis B liver disease. Perit Dial Int 2006; 26: 213–17.
5.Bajo MA, Selgas R, Jimenez C, Del Peso G, Fernandez-Reyes MJ, Dapena F, et al. CAPD for treatment of ESRD patients with ascites secondary to liver cirrhosis. Adv Perit Dial 1994; 10:73–6.

PD in patients with chronic ascites: practical aspects

- Optimal PD catheter placement:
  - Pre-operative measurement
  - Paramedian incision (to reduce hernia and leak risks)
- Only partially drain fluid at the initiation of PD and/or at catheter placement time
  - e.g. drain 20% extra over infused volume per exchange for the first 5 days (Bajo et al)
  - another scenario is to drain 1L, inflow 1L of 1/5%, dwell 1-2h and drain 1.5L at initiation of PD and continue until PD fluid completely drained (Chaudhary and Khanna)
- Strict attention to peritonitis prevention, Including:
  - longer training time if needed
  - Topical antimicrobial at exit site
  - Consideration of oral antimicrobial prophylaxis (as in chronic ascites management) – no clear data

-Bajo MA, Selgas R, Jimenez C, Del Peso G, Fernandez-Reyes MJ, Dapena F, et al. CAPD for treatment of ESRD patients with ascites secondary to liver cirrhosis. Adv Perit Dial 1994; 10:73–6.
-Chaudhary and Khanna. Perit Dial Int 28(2):113-117,2008

Question #1

- All of the following are true about Assisted Peritoneal Dialysis in the elderly, *except:*

A. It can be performed by a non-related family member
B. Costs of the care-giver make assisted PD more expensive than in-center HD
C. Increased utilization of PD was seen in Canada after implementation of an assisted PD program
D. Some elderly patients who start with assisted PD eventually become able to perform self-care PD

Answer:B, see slide #14

Question #2

- Icodextrin is beneficial for diabetics on PD because:

A. It causes faster ultrafiltration than 2.5% and 4.25% dextrose solutions

B. It does not cause appreciable hyperglycemia or hyperinsulinemia

C. It has negligible caloric load since it is not a dextrose solution

Answer: B; see slide #25

Question #3

Successful PD in obese patients requires:

A. Low volume dwells, to reduce the risk of hernia formation since obese patients have less abdominal muscle strength

B. Icodextrin at least once a day to avoid the caloric load of glucose dialysate

C. Larger total inflow volumes (per day) than non-obese patients

D. More than 6 exchanges per day

Answer: C, see slides 34-35