Options for Renal Replacement Therapy: Comparison of Modalities

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Goals

- Goal
  - Determine which option for renal replacement therapy (RRT) is ideal or appropriate for an individual patient.
  - Understand limitations in current literature in determining survival comparison of different options for RRT.
  - Review pertinent literature comparing options for RRT.
  - Identify benefits, risks and indications and contraindications of each modality.

Introduction

- Which modality is best?
  - How should we define best?
    - Survival quantity?
    - Survival quality? How do you define or measure quality?
      - Live long or live well?
    - Health policy perspective or individual patient perspective?
- Can we use literature to help make decisions for an individual patient?
  - Ideally, to make an evidence based therapeutic decision regarding a patient the study group in the literature should be representative of that particular patient.
  - Current literature on survival is observational data of a heterogeneous population and does not allow the practitioner to make scientific decisions for an individual patient.

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What do we mean by best? Observational data might yield useful information for health policy and economic implications of different modalities. But, physicians care for individuals and not groups of patients. Some patients want to live longer but most want to live better. Though there are many quality of life reports in the literature it is hard, if not impossible, to extrapolate those quality of life measurements to the expectations of your patient.

The issue is not which modality is better but rather which modality is best for the patient under your care.

If one of your patients asks which modality is better for him, peritoneal dialysis or hemodialysis, could you correctly answer the question based on literature? The correct answer is NO. The current literature does NOT help the clinician make an evidenced based decision for an individual patient.

The next section will highlight shortcomings in published survival literature and will enable you to critically read published literature.

Modalities

- Main focus
  - **Peritoneal dialysis (PD)**
    - Includes chronic ambulatory peritoneal dialysis (CAPD) and APD (automated peritoneal dialysis). APD includes CCPD (continuous cycler peritoneal dialysis) and NIPD (nightly intermittent peritoneal dialysis).
  - **Conventional hemodialysis (CHD)**
    - Thrice weekly in-center hemodialysis typically of 3-5 hour duration.
- Limited data
  - **Home hemodialysis**
    - Short daily hemodialysis (SDHD) : 5-6 days per week for 2- 3 hours per treatment.
    - Nocturnal hemodialysis (NHD): 5-6 night per week for 6-8 hours per treatment.
  - **In-center nocturnal hemodialysis (ICNHD)**
    - Thrice weekly in-center 6-8 hour treatments.

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There are many modalities available with different and advantages and disadvantages for patients. The bulk of literature deals with peritoneal versus hemodialysis patients. The main focus of this lecture on outcomes will compare and contrast these two modalities. I elected to include survival data from United States population studies only as it more appropriately reflects outcomes state of affairs in this country. There is some limited data on short daily hemodialysis and both home and in-center nocturnal hemodialysis which I will also present. Just recently the Frequent Hemodialysis Network (FHN) study comparing outcomes for short daily hemodialysis was published and will be included in the discussion.

Modality Survival

Peritoneal Dialysis
versus
Conventional Hemodialysis

Randomized Control Trial: PD vs CHD

- Ideal (though not always conclusive) study design.
- Only one RCT was published [1]
  - 38 dialysis units in Netherlands.
  - Of 1232 patients screened 773 patients eligible to participate.
  - Only 38 patients agreed to randomization.
  - Therefore limited data for conclusive results regarding survival.
- Unlikely to ever see a significant RCT comparing survival for PD and in-center HD in the future.

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Decisions comparing survival of peritoneal dialysis and in-center hemodialysis need to be based on observational studies given the extremely low likelihood that there will ever be a randomized controlled study.

Limitations of survival studies: PD vs CHD

- Population and methodology heterogeneity
  - Co-morbidities
    - Propensity versus regression analysis
  - Incident vs. prevalent patients
    - Prevalent patient studies will favor modalities with high early mortality
  - 90 day exclusion
    - USRDS database study measures mortality after 90 days (favors modality with high early mortality)
  - Cumulative vs. interval survival rates
  - Residual renal function
  - Dialysis vintage
  - Modality switching
  - Extent and quality of pre-dialysis care
  - Socio-economic factors

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Populations studies are heterogeneous and therefore various statistical methods are used to control for confounding factors. Some of the statistical methodologies are very complicated and are beyond the scope of this lecture as well as the abilities of this author. One of the concerns about studies that utilize USRDS database is that mortality is measured after initial 90 day period. These studies exclude patients with high initial mortality rates. Therefore to the extent that one modality may have a higher initial mortality rate, that modality may appear to have a better survival.

Interval survival rates examine survival rates in consecutive periods whereas cumulative rates report ongoing survival rates every year. For example: Examine a study in which first year survival rates for modality A and modality B are 90% and 75% respectively and second year survival rates are the same at 75%. Interval survival analysis would say that modality A is better than modality B in the first year but the survival advantage is no longer present in the second year. Cumulative survival analysis would say that survival in the second year for modality A and B are 67.5% (90% x 75%) and 56.3% (75% x 75%) respectively. Thus, survival for modality A is still better than modality B by the end of year two.

There may be many more factors (listed in slide) that impact on survival of different modalities that are not available for analysis in most observational studies.

Limitations of survival studies: PD vs CHD

- **Modality and delivery of care heterogeneity**
  - Center bias
    - Single center or dialysis provider vs multiple centers and providers
  - Center size
    - Larger programs have better outcomes [2,3]
  - CAPD vs CCPD or NIPD
  - Technologic advances
    - Studies do not reflect recent use of icodextrin
  - Target Kt/V differences
    - First RCT for target Kt/V for CAPD was published in 2002 [4].
    - First RCT for Kt/V in hemodialysis was published in 1985 [5].
- **Changes in survival over time**
  - More recent studies demonstrate improvement in PD survivals.

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Maybe the reason for different outcomes of different modalities is not an inherent difference in the effectiveness of the modality but rather how the modality is delivered. For example, studies that involve predominantly one dialysis provider might reflect the equipment, policies, procedures, protocols and staffing of that company. Similarly larger PD programs have better outcomes than smaller programs.

Studies group all peritoneal dialysis modalities together and do not allow for the possibility that different options for PD (CAPD, CCPD, NIPD) might have different outcomes.

Maybe most importantly, there have been significant technologic advances in peritoneal dialysis equipment and solutions (specifically use of icodextrin) that are not reflected in older studies. Similarly, goals for urea Kt/V for HD were more clearly established many years before goals were identified for PD. Therefore it is conceivable that dialysis dose was much different in HD and PD in some of the observational studies.

Literature Review: PD vs CHD

- Goal of this section is to present a historical perspective.
- Common misperceptions about comparison survival between PD and CHD are based on some of the studies presented.
- The studies presented were not selected because of their merits, but to point out short comings and pitfalls in observational studies comparing survival in PD vs HD.

Literature Review: PD vs CHD

- Bloembergen 1995: studied incident and prevalent patients on therapy 1987-1989 [6].
  - PD 19% overall increase risk of death but no difference in patients age <55. Higher risk in diabetics. Did not examine other co-morbid conditions.
  - ***Criticism:*** *Old data and limited pertinence to today; did not account for dialysis dose.*
- Fenton 1997: studied incident patients from 1990-1994 [7].
  - Included some co-morbid conditions as well as primary renal diagnosis.
  - PD patients had a lower mortality first 2 years of therapy but less pronounced in diabetics and patients older than 65.
  - ***Criticism:*** *Again, old data but again suggests increase risk in diabetics and older patients.*

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Apologizes to authors of papers not listed. I included some widely referenced and informative observational studies on survival in PD vs. HD along with noted criticisms of the studies. They appear in chronologic order and highlight some of the controversies and criticisms of literature. This is not meant to be a comprehensive review of survival literature. They, in total, underscore limitations in using current data to draw conclusions about which modality has better survival. There is a recurrent theme in some of these studies (with the exception of the 2010 study of Weinhandl) that older diabetic patients with certain co-morbidities might have better outcomes on HD rather than PD. Moreover, though studies report a survival benefit, they do not report how long that benefit is. Please see slide notes for slide 16 and reference 12 (Mehrotra R, et al, *Arch Intern Med.* 171:110-118, 2011). This study reports that though there may be statistical improvement in survival for an older diabetic with co-morbidities on hemodialysis, the benefit translates to less than 2 months. If one factors in travel time to dialysis, post dialysis fatigue and quality of life, this “survival benefit” may not be relevant. Certainly, this data does not allow us to counsel individual patients.

Literature Review: PD vs CHD - con't

- Vonesh 2004: 398,940 incident Medicare dialysis patients between 1995 and 2000 [8].
  - Controlled for age, diabetes and some co-morbidities.
  - Found lower risk of mortality for PD in non-diabetic patients with no co-morbidities of all age groups and diabetic patients with no co-morbidities age <45. HD had lower risk in all diabetic patients older than age 45 regardless of co-morbidities. PD and HD had same risk in non-diabetic patients with co-morbidities of all age groups and diabetics age <45.
  - *This study also includes old data and has usual criticisms of observational studies but suggests that older diabetics have less risk on HD and younger patients have less risk on PD.*

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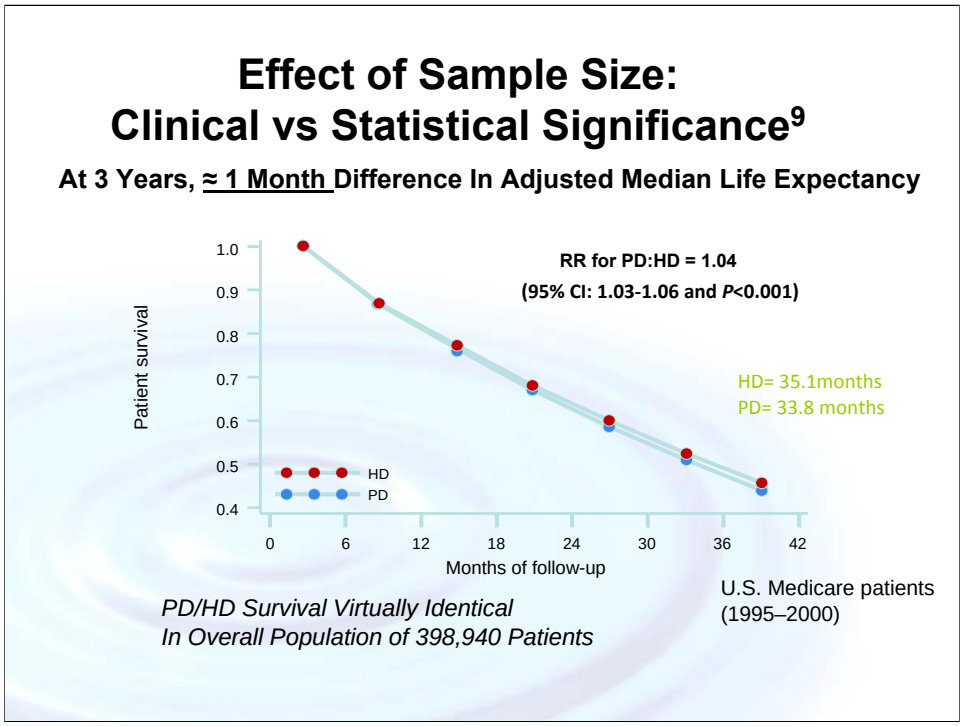
Co-morbidities included congestive heart failure ischemic heart disease/myocardial infarction, cardiac arrest/dysrhythmia, cerebrovascular disease, peripheral vascular disease, chronic obstructive pulmonary disease, current smoking status, cancer and inability to ambulate/transfer.



In a subsequent paper Vonesh commented on some of his findings. The important take home point is that even though there was a statistically significant different in relative risk of death, the difference in life expectancy was trivial: 33.8 months for PD and 35.1 months for CHD.

- Population-averaged survival curves comparing adjusted PD and HD survival for nearly 400,000 U.S. Medicare patients (1995–2000) illustrate the similarity of survival with PD or HD

- Although the overall RR of death for PD versus HD was estimated to be 1.04 at 3 years, with a narrow confidence interval (95% CI: 1.03-1.06) and *P*<0.001, this statistically significant difference did not represent a clinically significant difference between modalities

- Adjusted median life expectancy was 35.1 months with HD and 33.8 months with PD; the 1-month difference may not be clinically significant, particularly if it is offset by quality of life benefits for home therapy

Literature Review: PD vs CHD - con't

- Jaar 2005: Studied 1041 incident dialysis patients (274 PD) during period 1995-1998. 90% of patients from one dialysis provider [10].
  - Prospective, non-randomized cohort study.
  - Found same first year survival but increased risk for PD in second year.
  - ***Criticism:*** *relatively small study, possible center bias because of one provider. 25% of PD patients and 5% of HD patients switched modality.*

Literature Review: PD vs. CHD - con't

- Weinhandl 2010: Retrospective study of 6337 incident patient pairs (propensity matching) who initiated dialysis in 2003 [11].
  - Subgroups analysis of patients by age (65), diabetes, and CVD.
  - Demonstrated different survival curves if measurement was from initiation of dialysis (day zero) or from 90 day after dialysis initiation.
  - Demonstrated superior survival from dialysis initiation (day zero) in PD patients at 12, 24 months but no difference at 36 and 48 months.
  - Using mortality from day zero, PD survival was similar or better than HD in all subgroups for both year 1 and year 4. Only subgroups of HD patients with better survival were age >65 at year 2 and 3 (but not year 1 and 4) and diabetics at year 3 but not years 1,2 and 4.

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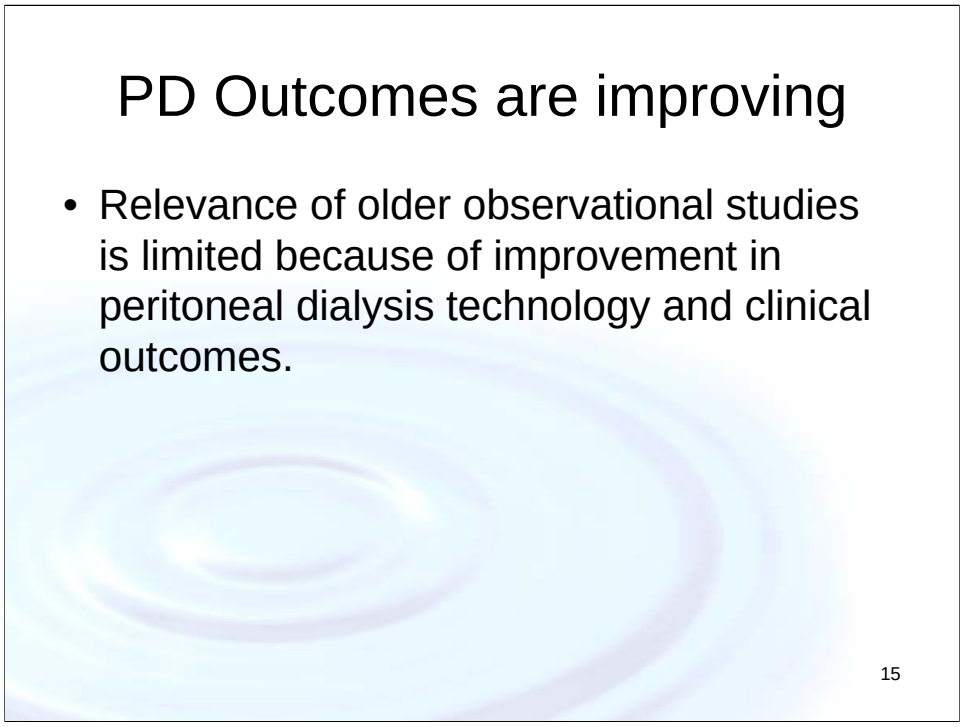
This study demonstrated difference in survival rates using day 0 or day 90 as initial period. It also used a more current dialysis population. Conclusion of authors: "the overall intention-to-treat mortality risk after dialysis initiation was 8% lower for peritoneal dialysis than for matched hemodialysis patients. These data suggest that increased use of peritoneal dialysis may benefit incident ESRD patients."



Decisions (and convictions) about relative survival benefits of PD versus CHD should be based on more current literature because of evolving improvement in peritoneal dialysis techniques.

PD Outcomes are improving [12]

Table 3. Adjusted Hazard Ratios (HRs) for Mortality, Stratified by Cohort Periods, Using Marginal Structural Models With Inverse Probability of Treatment and Censoring Weighting[a]

Cohort	HR (95% CI)[b]	*P* Value
1996-1998	1.07 (1.04-1.11)	<.001
1999-2001	1.08 (1.06-1.11)	<.001
2002-2004	1.03 (0.99-1.06)	.10

Abbreviations: CI, confidence interval; HD, hemodialysis; PD, peritoneal dialysis.

[a]Median follow-up time for HD patients with incident ESRD: 1996-1998, 29.1 mo; 1999-2001, 29.5 mo; and 2002-2004, 30.0 mo. Median follow-up time for PD patients with incident ESRD: 1996-1998, 24.9 mo; 1999-2001, 27.0 mo; and 2002-2004, 28.8 mo.

[b]Overall relative risk of death between PD and HD over the course of a 5-year follow-up.

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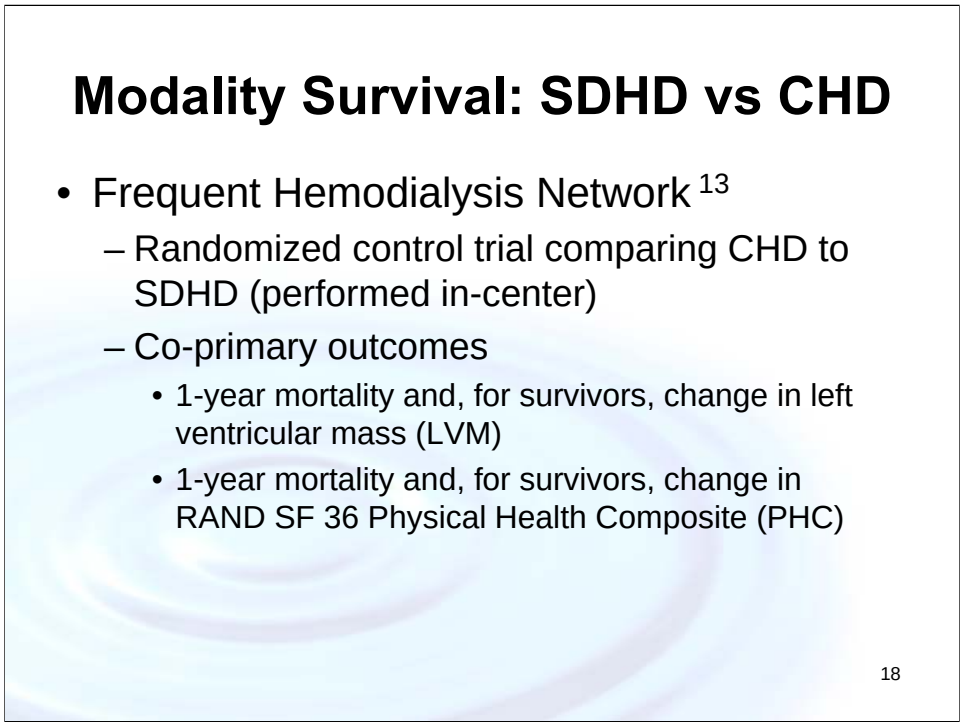
This recently published study compared survival of PD versus CHD patients during three time periods based on USRDS database.

There was a progressive attenuation in the higher risk for death seen in patients treated with PD in earlier cohorts; for the 2002-2004 cohort, there was no significant difference in the risk of death for HD and PD patients through 5 years of follow-up. The median life expectancy of HD and PD patients was 38.4 and 36.6 months, respectively. Analyses in 8 subgroups based on age (<65 and ≥65 years), diabetic status, and baseline comorbidity (none and ≥1) showed greater improvement in survival among patients treated with PD relative to HD at all follow-up periods.

Modality Survival

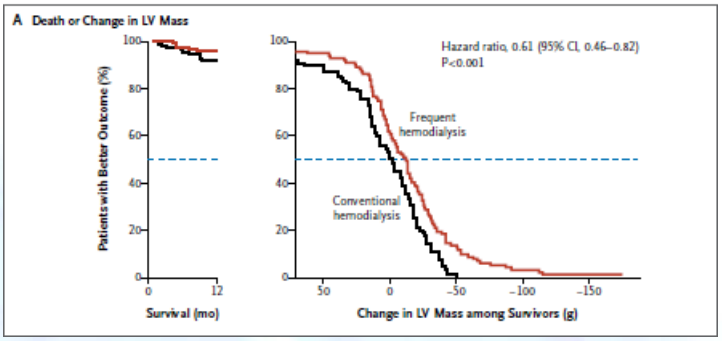
Short Daily Hemodialysis versus Conventional Hemodialysis



FHN trial was the only randomized control trial that successfully compared survival for 2 different dialysis modalities. It is a landmark study that measured outcomes over a one year follow-up period in patients treated with CHD versus SDHD. Even in this relatively brief follow-up period of one year, statistically significant improvements in both co-primary outcomes were demonstrated.

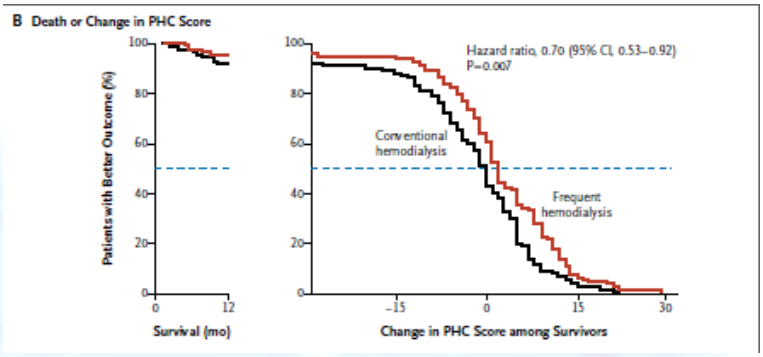
In addition there were statistical significant improvements in secondary outcomes of LV mass, PHC, phosphorous levels and systolic blood pressures in the SDHD group.

FHN SDHD Study



Co-primary endpoint:
1-year mortality and, for survivors, change in LVM
RESULTS: Statistical significant improvement

FHN SDHD Study



Co-primary endpoint:
1-year mortality and, for survivors, change in PHC
RESULTS: Statistical significant improvement

Overview:

Advantages, disadvantages and other factors contributing to patient modality selection

- Conventional Hemodialysis
- Peritoneal Dialysis
- Home (more frequent) Hemodialysis
- In-center Nocturnal Hemodialysis

In-center hemodialysis

- Accounts for 92% of US dialysis patients.
- Patient and patient family do not need to participate in delivery dialysis.
  - Though some dialysis units have “self-care” options where patients cannulate themselves, monitor vital signs and administer saline as needed.
  - Good for patients who are not independent and lack support system.
- Allows for better monitoring of adherence with treatments and administration of parenteral medications (erythropoietin and vitamin D analogues).

In-center dialysis

- Outcomes
  - High mortality rate.
  - Infections are frequently bacteremia and lead to increase mortality [14].
- Quality of Life
  - Inflexible schedule.
  - Most patients have hypertension requiring medications.
    - Hypertension fluctuates during inter-dialytic period [15] .
  - Travel to dialysis and planning a vacation is difficult.
  - Inability to work.
  - Post dialysis fatigue.
  - Decreased cognitive function/sense of well-being.

PD: Advantages

- Patients more satisfied with overall care compared with HD[16].
- Flexible schedule
  - Especially attractive for patients who work or have children at home
- Ease of travel
- Partner not required
- Body image
  - Catheter concealed under clothing
  - No permanent disfiguring of arm seen in hemodialysis access
- “Needless and bloodless”
  - Lower risk bacteremia
- Steady-state treatment
  - Better hemodynamic stability.

PD: Advantages, con't

- Opportunity to control BP with minimal if any blood pressure medications if diet and prescription appropriately adjusted [17].
  - Requires staff attention to dialysis prescription
- Better preservation of residual renal function[18].
- Less "lead time" for access placement.
  - Can place PD catheter within 2 weeks of starting PD
  - CHD requires months to develop mature AVF. 80% of CHD patients start HD with a central venous dialysis catheter
- Lower cost than HD.

Special Populations that may benefit from PD

- No or difficult venous access
  - Central vein occlusion
  - “Steal syndrome”
- High risk and morbidity of bacteremia
  - Recurrent bacteremia and endocarditis
  - Endovascular device: e.g. mechanical valve
- Patients who cannot tolerate HD because of cardiomyopathy, ischemic heart disease or extensive peripheral vascular disease
  - Allows for more gentle and continuous fluid removal
- Prolonged ATN
- Bridge to transplant

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Modality selection should be based on patient preference but at times patient co-morbidities and complications dictate a change. We should consider and utilize all modality options at different points in time as patient social and medical conditions change. Some CHD patients cannot continue hemodialysis because of access complications and changes in medical condition. PD should be considered for other patients, short duration of dialysis (either because of planned transplant or anticipated return of renal function) to avoid unnecessary venous access.

PD: Challenges

- Peritonitis
  - Rates are improving
- Catheter insertion and mechanical complications
  - Hernias and catheter malfunction
  - Requires committed surgeon
- Metabolic complications
  - Protein losses
  - Hyperglycemia
  - Hypertriglyceridemia
  - Weight gain
  - **Icodextrin** can mitigate hyperglycemia, hypertriglyceridemia and weight gain

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Peritonitis is a risk in PD patients but rates have significantly decreased. Patients are at risk for developing hernias, fluid leaks and malfunction of PD catheters. Therefore, it is imperative to utilize a surgeon who is aware of special needs of PD patients and ideally can perform procedures with a laparoscope. There are some protein losses during PD, and along with excessive glucose absorption from PD fluid, can contribute to challenges maintaining nutritional status.

PD: Challenges

- No days off
  - Patient and family burnout
  - If significant residual renal function, can decrease prescription and possibly provide days off
- Body image
- Technique failure
  - Better in larger programs
- Supply space
  - Smaller living spaces may not have room for supplies and might require more frequent home deliveries

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Not all patients require full dose peritoneal dialysis. Many physicians introduce low dose, “incremental” PD in patients who have significant residual renal function but not enough to avoid dialysis, or in patients with heart failure who need additional fluid removal. In these patients innovative PD prescriptions can give patients time off and may decrease patient “burnout”.

Smaller programs have a higher rate of technique failure than larger programs and it is important to have PD dedicated nursing staff. Typical space required for supplies is 4-5 feet x 4 feet x 1 foot which may be difficult for patients living in small apartments or homes.

PD: Contraindications

- Absolute
  - Large mesenteric resections
  - Cutaneous feeding tubes
  - Known peritoneal defects or pleural communications
  - Severe chronic obstructive disorders
- Relative
  - Ostomies, urostomies
  - Multiple adhesions
  - Large abdominal hernias
  - ?Obesity (more than 125 kg)

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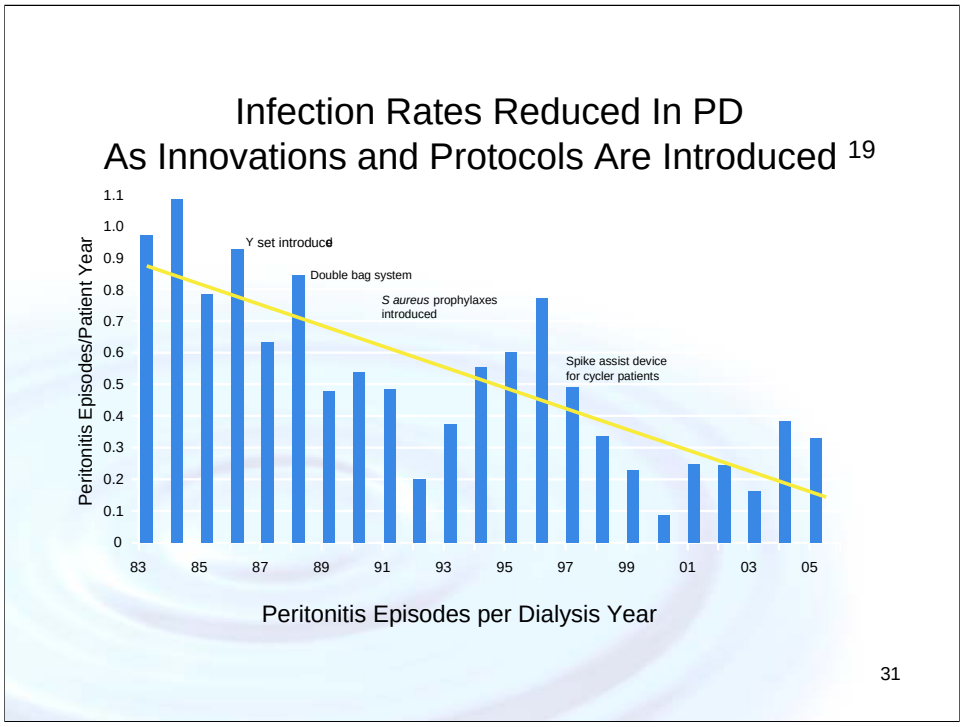
The expertise of the surgeon will help determine which patients are candidates for PD given surgical history. Often an experienced surgeon will inspect the peritoneum with a laparoscope and will lyse adhesions and fix repairs. There is a high rate of peritonitis in patients with cutaneous feeding tubes. Patients with some ostomies can perform PD successfully but the exit site of the catheter should be remote from the ostomy (e.g parasternal catheter). Finally there is a debate regarding survival and adequacy of PD in obese patients with some literature supporting use of PD. This author successfully treated an 150 Kg patient on PD who had significant residual renal function. For this patient surgeon performed a simultaneous laparoscopic PD catheter placement and gastric banding to help with weight loss.

Common PD misconceptions

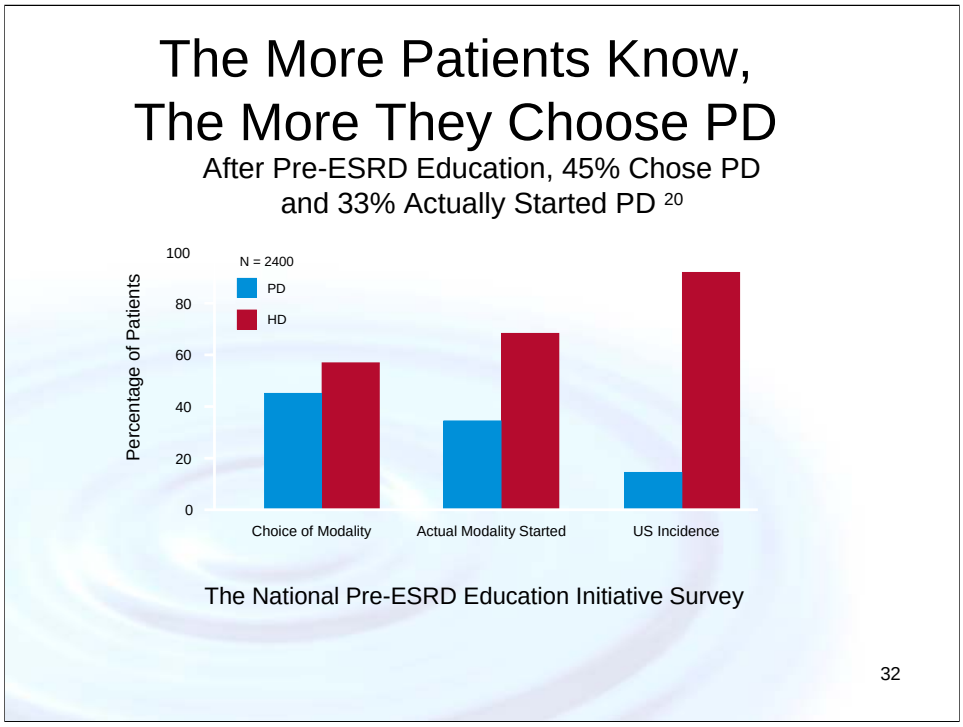
- "Survival is worse"
  - Addressed in beginning of talk.
- "Can't achieve adequate solute clearance"
  - 2000 KDOQI recommended Kt/V of 2.0 but based on subsequent RCT the target was set at 1.7. It is fairly easy to achieve this goal in most patients.
- "Infection rate too high"
  - Peritonitis rates are decreasing- see next slide. Furthermore risk of bacteremia is lower on PD than HD and bacteremia is associated with significant morbidity and cardiovascular death.
- "Patients don't want PD"
  - Just not true – see next slide



•Not only are new agents and technologies available to reduce rates of peritonitis in PD, but protocols can be implemented to further reduce the risk of infection

•Very low rates of peritonitis can be achieved by introducing innovations such as double bag systems, spike assist devices, and antibiotic prophylaxis

•In addition, protocols including proper catheter placement, careful training of patients with periodic retraining, thorough hand washing with complete drying, and aggressive treatment of exit-site infection have significantly reduced PD-related infections



•Studies have demonstrated that the more patients know about their RRT options, the more they choose PD. Pre-ESRD education has been known to increase the percentage of patients choosing PD.

Summary: Modality Comparison Patient Preferences

CHD	PD
Dependent –patients are taken care of	Independent: patients are empowered for self-care
Rigid Schedule – difficult to travel	Flexible schedule – easier to travel
Venous access – needle sticks	Peritoneal Access – “bloodless”
Access Complications	Access Complications
Bacteremia	Peritonitis
Steal	Fluid leak
Central vein occlusion	Hernia
Home Consideration :None	Home Consideration: Storage space
Post-dialysis fatigue: average recovery 8 hours	No post dialysis recovery or fatigue

Home Hemodialysis Options

- Short Daily (SDHD)
  - 5-6 days per week
  - 2-3 hours per treatment depending on body size and equipment used
  - Equipment options
    - Traditional dialysis equipment: requires plumbing and electrical modification to the home. Equipment not portable.
    - NxStage- Low dialysate volume/high efficiency with portable dialysis machine. Patients can travel.

Home Hemodialysis Options

- Nocturnal (NHD)
  - Typically 5 days per week for 6-8 hours depending on patient's sleep habits.
- Hybrid (SDHD and NHD)
  - Knowledgeable patients can alternate between short daily and nocturnal hemodialysis depending on schedule. Allows for more flexibility. Few patients or physicians utilize this strategy.
- Conventional
  - For patients who prefer comfort of home dialysis but not committed to performing more frequent dialysis. Does not provide benefits of more frequent hemodialysis but can serve as a "bridge" to home NHD or SDHD.

Home (more frequent) HD: Advantages

- Outcomes
  - Improved Survival
    - Observation suggests improved survival compared with in-center HD [25].
    - Observational data suggests equivalent survival to renal transplant [26].
  - Quality of life [21,22]
    - Average recovery time after dialysis treatment is 30-60 minutes compared with 420-480 minutes for in-center HD.
    - Patients feel better and have less intra-dialytic symptoms.
    - Maybe less hospitalizations [24]
    - Ability to travel

Home HD: Advantages, con't

- Better phosphorous control
  - Nocturnal hemodialysis patients maintain normal serum phosphorous levels on no or less phosphate binders[23].
  - SDHD patients do not have impressive improvement.
- Cardiovascular
  - Less BP medications – most patients on none[23].
  - Regression LVH
- Sleep apnea [27].
  - Patients sleep better with less episodes of hypopnea and apnea

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Major and probably most significant benefits of home (more frequent) HD relate to improvement in cardiovascular risk factors: regression LVH, better blood pressure control, improvement in phosphate control and improvement in sleep apnea.

HHD: Patient Selection
Inclusion and Exclusion Criteria

- Home environment: requires reasonably sanitary conditions with appropriate water supply and electricity. Similar to PD, patients require sufficient space for storage.
- Patient and/or partner's abilities: Most patients require a partner though many patients do dialysis alone. They require basic skills including ability to read basic instructions, visual acuity, ability to hear alarms and basic manual dexterity.
- Patients need a cooperative attitude and must adhere to all procedures.
- Patient and/or partner need to be able to make appropriate decisions or follow instructions. They should not have significant psychiatric disease, chronically use of sedating medications, have a history of ongoing illicit drug use, have significant neurologic disease or dementia.

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In-center nocturnal hemodialysis

- Slow, 7-8 hr treatment during the night allows for more gentle fluid removal
- More overall dialysis treatment time
- Especially beneficial for large patients with inadequate clearance, patients with chronic volume expansion or hyperphosphatemia.
- Allows patients to have days free and is an good alternative option for patients who want to work or have other daytime obligations.
- Improved patient outcomes
  - Possibly lower mortality and hospitalization compared with in-center HD [28].
  - Improved blood pressure control with less blood pressure medication [29].
  - Improvement in nutritional status [29].

Question #1

- A 58 year old female with stage 4 CKD secondary to autosomal dominant polycystic kidney disease is approaching the need for renal replacement therapy. She does not have a potential kidney donor and has been on the transplant waiting list for about 2 years. She was told by the transplant team that it might be another 2-3 years before she receives a deceased donor kidney. She has a history of mitral valve replacement secondary to severe mitral valve prolapse with regurgitation. She works full time and has teenage children at home who are on several high school varsity teams. She wants to know what are the advantages and disadvantages of the different dialysis modalities specifically as they pertain to her. She also wants to know if ADPKD is a contraindication for PD.

- Please discuss specific benefits and risks of each modality.

Answer #1

- Most striking in her history is the presence of a mitral valve replacement. For certain we would like to decrease her risk of bacteremia and potential endocarditis. The risk of bacteremia is less with PD than HD. Therefore PD might be better than all the hemodialysis options.
- She has residual renal function (RRF) and presence of RRF predicts outcome in both PD and HD. She still has a significant wait before her kidney transplant and we would like to keep her as well as possible until then. PD preserves RRF and would likely be maintained to some degree until he receives a kidney transplant.
- She would like to continue work and PD gives her the flexibility to continue to work and to attend his kid's games!
- Finally, recent literature reports no difference in survival, technique failure or peritonitis in PD patients with ADPKD compared to non-diabetic matched controls[30].

Question #2

- A 39 year old male with ESRD secondary to focal glomerulosclerosis (FGS) is currently on hemodialysis and is doing very poorly. His blood pressure is high despite 3 medications and his treatments are characterized by severe intra-dialytic hypotension. He feels “washed out” after dialysis. He had two failed kidney transplants, one due to recurrent FGS and was told he is not a candidate for a kidney transplant. He was on PD for 5 years before his renal transplants and no longer has RRF. His work performance is failing and he fears he will be fired. More importantly he cannot spend enough quality time with his 5 and 7 year old sons. He has an excellent AVF.
- He wants to know what his options are.

Answer #2

- He needs a modality that will give him flexibility so he can continue work and play with his children. But he also needs a modality that will give him the energy to work and keep his blood pressure under control.
- PD could address these issues but he no longer has residual renal function, and was on PD for 5 years and therefore we don't know how well his peritoneum will perform. More importantly, in this young man with children, who will never get a kidney transplant, he doesn't want to measure survival in years but rather in decades.
- Therefore his best option is home more frequent hemodialysis; either SDHD or nocturnal HD. Both these therapies will improve BP control on minimal medications and will decrease post dialysis fatigue. His schedule will be more flexible and he should be able to continue working.

Question #3

- A 62 year old male has been on hemodialysis for 4 years and has no interest in PD. He weighs 298 pounds and loves to eat. He is still in pretty good shape and exercises regularly. His typical weight gains between treatments are 4-5 kilograms. His blood pressure is always high and he typically has 1+ edema. His phosphorous levels are typically around 8 mg/dL and are never normal even if he takes all his phosphate binders. He is on 5 hour treatments 3 days per week and his urea Kt/V measurements are only 1.1-1.2. He lives alone in a small apartment. He doesn't work but likes to babysit for his grandchildren during the day.
- What recommendations can you make for better dialysis therapy and why?

Answer #3

- He has reached the limit of what conventional can provide and is still inadequately dialyzed. He needs more dialysis that can be provided with either more frequent treatments, longer treatments or both. Ideally he should receive nocturnal HD 5 days per week but his home situation may not allow it. Therefore the best solution for him is in-center nocturnal HD three times per week. Eight hour treatments will be able to remove fluid and will improve phosphorous control. He will definitely achieve target Kt/V in an 8 hour treatment. And since he will dialyze (and sleep) at night he has the added benefit of free time during the day to play with his grandchildren.

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