

The ESRD Patient on Dialysis

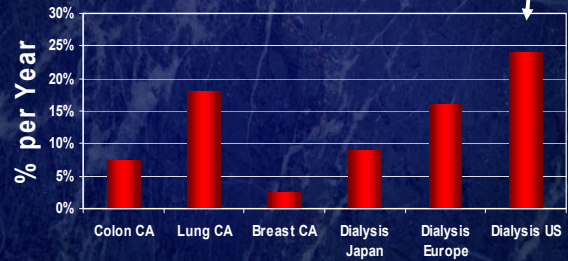
What their Dentist needs to know

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Annual Mortality Rates

Annual mortality from CVD is 20 X higher for those with ESRD



Complications Of Uremia

- Anemia
- Bleeding disorders
- Metabolic Acidosis / electrolyte disorders
- Peripheral Neuropathy
- Restless Legs Syndrome
- CNS Toxicity
- Sleep Disorders
- Impotency
- Amenorrhea
- Abnormal Lipids
- Vascular disease
- Pericarditis
- Hypertension
- Hyperparathyroidism
- Bone disease
- Gastritis/Colitis
- Constipation
- Pseudogout / Periarteritis
- Hyperpigmentation
- Pruritus



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State of Inflammation

Complications Of Uremia

- Anemia
- Bleeding disorders
- Metabolic acidosis
- Pseudotumor cerebri
- Rickets
- Sleep Disorders
- Impotency
- Amenorrhea
- Abnormal Lipids
- Vascular disease
- Pericarditis
- Pseudogout, Periarteritis
- Hyperpigmentation
- Pruritus

Cardiovascular Disease

Dialysis Goals

- Remove all toxins and correct electrolyte abnormalities
- Remove excess water
- Correct alterations in acid/base balance
- Accomplish tasks without unnatural oscillations in electrolyte, and fluid balance, and without increasing inflammation
- Minimally interfere in patient's lives

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Keep people healthy

Unphysiology of 3x/wk Dialysis

Carl Kjellstrand, MD

- Hemodynamic instability
- Electrolyte and acid/base abnormalities
- Anemia
- Bone disease
- Sleep disorders
- Poor appetite / malnutrition
- Neuropathies / restless legs
- Decreased quality of life

Unphysiology of Dialysis

- Cardiovascular Disease
 - Anemia
 - Hypertension
 - Hypotension
 - Inflammation
 - Hyperphosphatemia

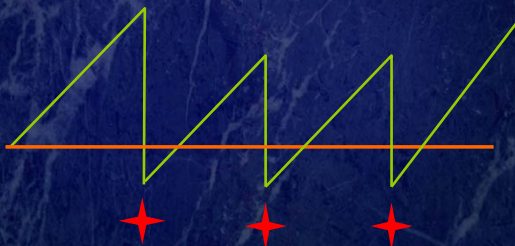


3x/week dialysis Rapid Fluid and Electrolyte Shifts

- Cramping
- Headaches
- Nausea and vomiting
- Drops in BP
- Feeling washed out
- Arrhythmias



Conventional 3x/week Hemodialysis



What can change ?

- Frequency of dialysis
- Length of dialysis
- Method of dialysis
- Dialysis setting
- Technology



Options

- Home daily/frequent hemodialysis
- Home nocturnal hemodialysis
- Home conventional hemodialysis
- Incenter daily/frequent hemodialysis
- Incenter nocturnal hemodialysis
- Incenter conventional hemodialysis
- Peritoneal dialysis



Options

- Home daily/frequent hemodialysis
- Home nocturnal hemodialysis
- Home conventional hemodialysis
- Incenter daily/frequent hemodialysis
- Incenter nocturnal hemodialysis
- Incenter conventional hemodialysis
- Peritoneal dialysis + Home



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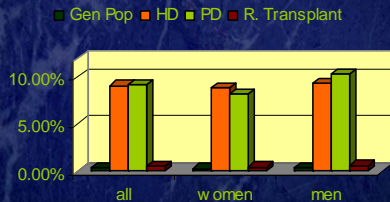
Unphysiology of Dialysis

- Cardiovascular Disease
 - Anemia
 - Hypertension
 - Hypotension
 - Inflammation
 - Hyperphosphatemia
- #1 cause of morbidity and mortality



ESRD and Mortality from CVD

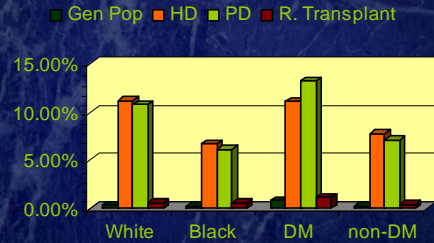
% Annual Mortality



Sarnak MJ, Levey AS. J AM Soc Nephrol 1998

ESRD and Mortality from CVD

% Annual Mortality



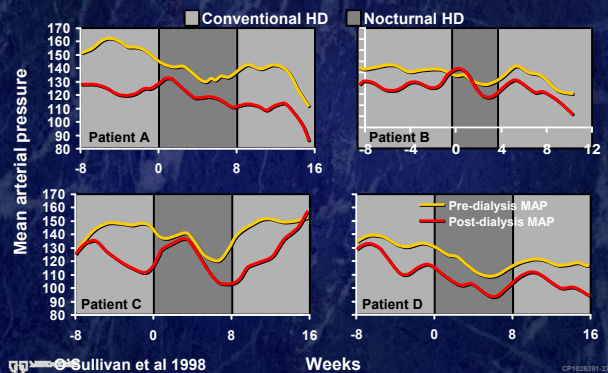
Sarnak MJ, Levey AS. J AM Soc Nephrol 1998

Unphysiology of Dialysis

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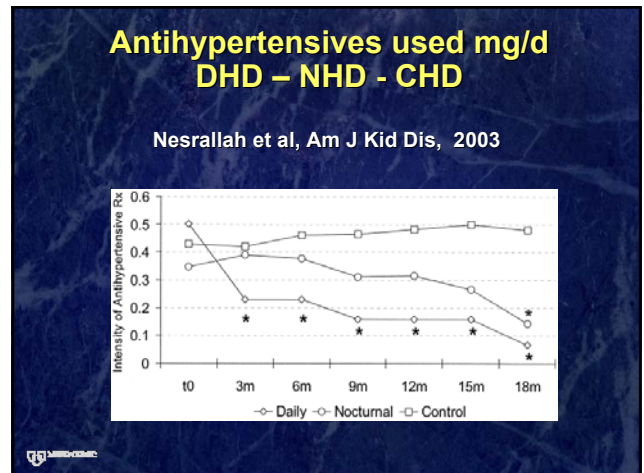
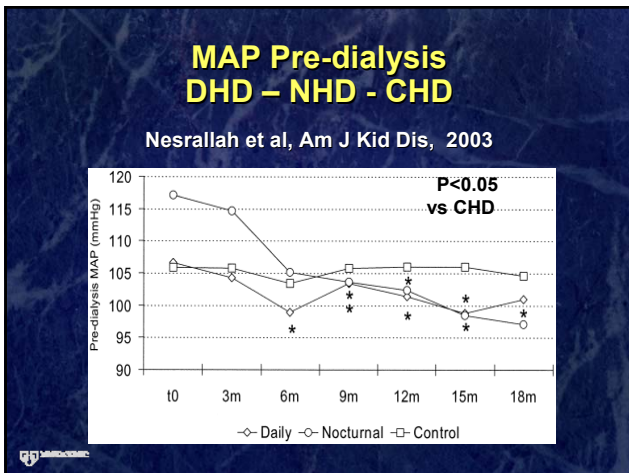
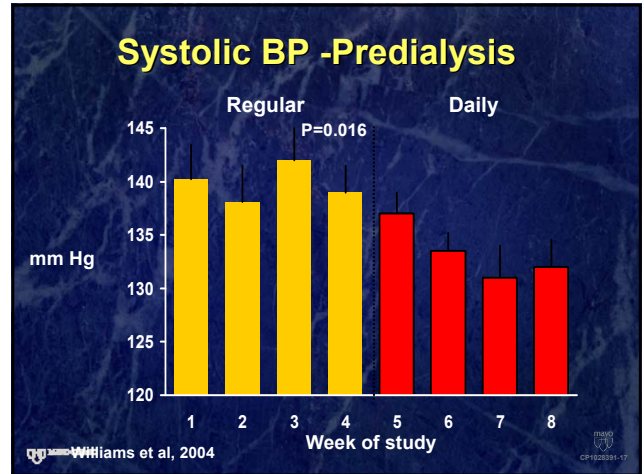
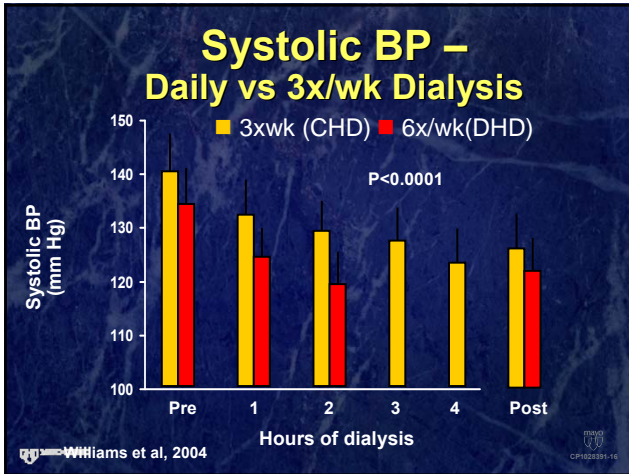
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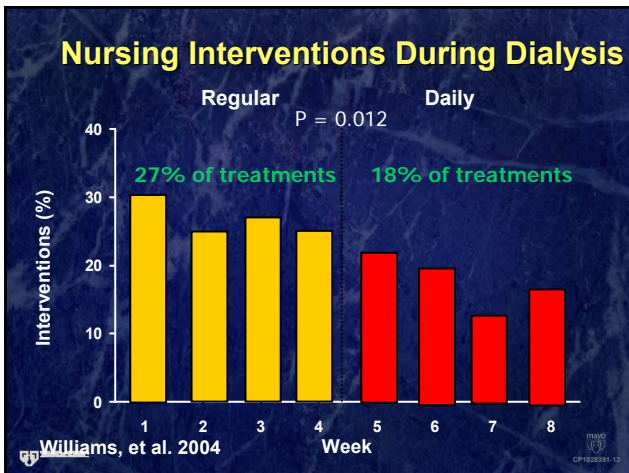
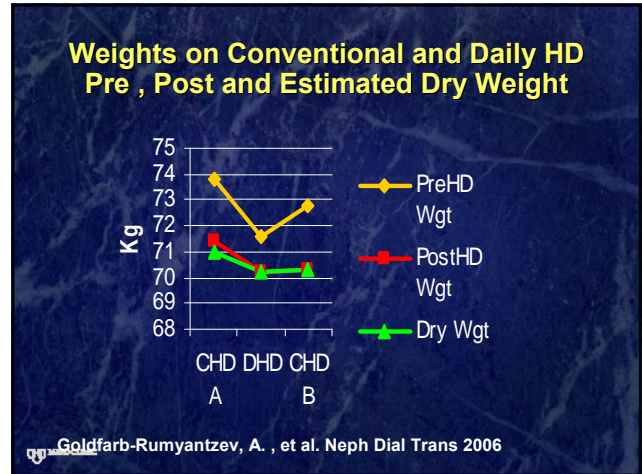
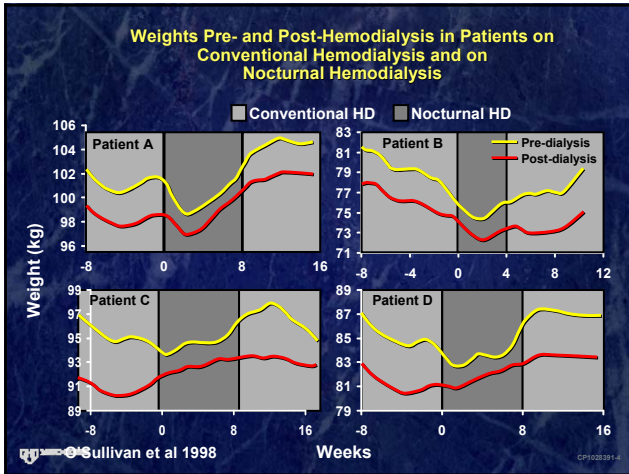
Mean Arterial Blood Pressure During Nocturnal HD and Conventional HD



Sullivan et al 1998

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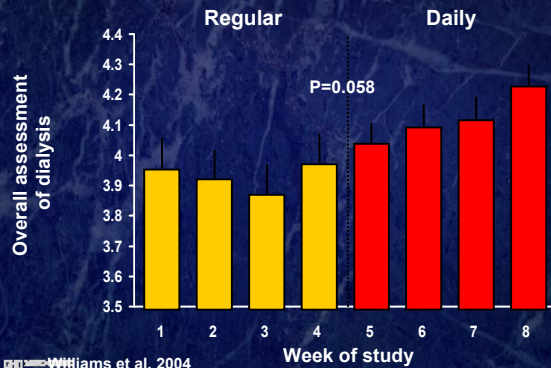
Symptoms during dialysis

	3x/wk	6x/wk	P
<u>Cramps</u>	9%	2%	<0.0001
<u>Chills</u>	3%	0.4%	0.019
<u>HTN</u>	1.2%	0%	0.038

Less symptoms on daily dialysis

Williams et al, 2004

Assessment of Dialysis



Frequent Hemodialysis Hemodynamic Parameters

- Improved BP control with less antihypertensives
- Achieved “dry weight”
- Decreased intra- and inter-dialytic weight changes
- Decrease in intra- and inter-dialytic hypotension
- Decrease in intra- and inter-dialytic symptoms

Association between CKD and CVD

- | 432 patients starting dialysis | Survival if present at baseline |
|--------------------------------|---------------------------------|
| • 16% systolic dysfunction | → 38 months |
| • 41% concentric LVH | → 48 months |
| • 28% LV dilation | → 56 months |
| • 84% abnormal ECG | |

Parfrey, PS. Et al. Nephrol Dial Transplant, 1996

Association between CKD and CVD

- 16% systolic dysfunction
 - 41% concentric LVH
 - 28% LV dilation
- Increased risk of Symptomatic Heart Failure
- Independent Predictor of Death

Parfrey, PS. Et al. Nephrol Dial Transplant, 1996

Frequent Hemodialysis Cardiovascular Improvements

- Near normalization of LV mass
(Buoncristiani et al, 1999, Chan et al, 2001, Woods et al, 2000)
- Improvement in LV function
(Chan et al, 2001, Woods et al, 2000)
- Lower mean homocysteine (P=0.001)
(Friedman et al, 2002)
- Lower BNP levels
(Goldfarb-Rumyantzev, A. , et al. 2006)



Unphysiology of Dialysis

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Frequent Hemodialysis Anemia

- Increase in hemoglobin
- Decrease in iron stores
 - require iron supplements IV
- Decrease in EPO requirement



Unphysiology of Dialysis

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CKD/ESRD effects on CVD Risk Factors Inflammation

- Stage 5 CKD – increased pro-inflammatory cytokines
 - Increased CRP levels
 - Increased oxidative stress
 - Decreased clearance of pro-inflammatory substances

Associated with CV mortality and morbidity



CKD/ESRD effects on CVD Risk Factors Inflammation

- Stage 5 CKD – increased pro-inflammatory cytokines
 - Increased CRP levels
 - Increased oxidative stress
 - Decreased clearance of pro-inflammatory substances
- Decreases albumin and is associated with malnutrition

Promoter of ASVD

Associated with CV mortality and morbidity

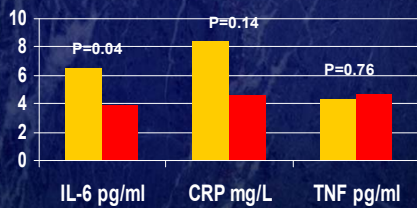
Associated with increased mortality



Mediators of Inflammation Conventional vs. Nocturnal Dialysis

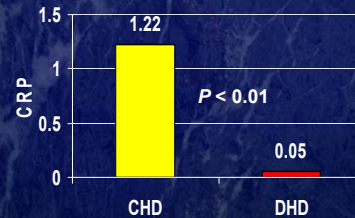
Yuen et al, 2005

■ 3x/wk ■ NHD



Mediators of Inflammation Conventional vs. Daily Dialysis CRP

Ayus et al. 2005



Nutritional Improvements on DHD

Galland 2004

Mean follow-up on DHD 39.1 ± 23.5 months

Improvement in

- Daily Protein intake P<0.005
- Energy intake P<0.01
- Phosphorus intake P<0.05
- Sodium intake P<0.005
- nPNA P<0.01
- Albumin/prealbumin P<0.001/P<0.05
- BMI P<0.001



Unphysiology of Dialysis

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#1 cause of morbidity and mortality



Hyperparathyroidism (elevated Ca-Phos product) and Vitamin D deficiency

• Cardiovascular disease

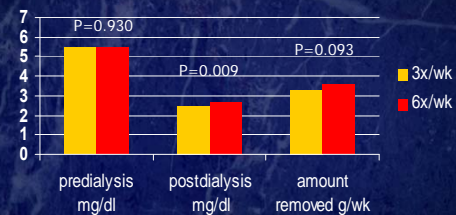
- HTN
- LVH
- CAD
- Increased vascular resistance

• Decreased survival

• Oral/Dental disease



Changes in Phosphorus Conventional vs. Short Daily Dialysis



Williams et al, 2004

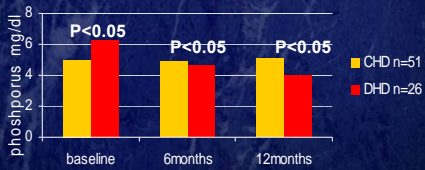
Daily Dialysis

10% increase in weekly removal



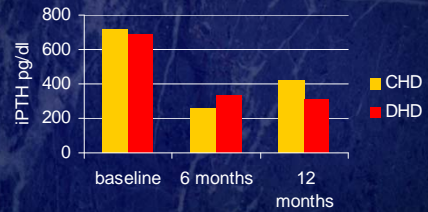
Phosphorus Levels Conventional vs. Daily (3 hrs) Dialysis

Daily Dialysis (3hrs, 6x/wk)
73% withdrawal of binders



Baseline vs. 12 months $P<0.004$ Ayus 2005

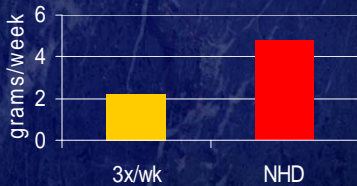
PTH Conventional vs. Daily (3hrs) Dialysis



Baseline vs. 12 months $P<0.05$

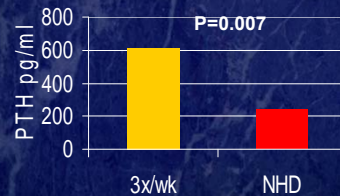
Ayus 2005

Phosphorus Removal Conventional vs. Nocturnal Dialysis



Pierratos 2004

PTH Conventional vs. Nocturnal Dialysis



Pierratos 2004

Frequent Hemodialysis Calcium / Phosphorus Balance

- Cumulative weekly phosphorus removal:
NHD > DHD > CHD
- NHD & (3hrs, 6x/wk) DHD:
Normalization of serum phosphorus,
no or decreased phosphate binders,
no or less dietary restrictions



Calcium / Phosphorus Balance

- NHD & (3hrs, 6x/wk) DHD:
Improvement in PTH
- NHD: Resolution of metastatic calcifications

(Ayus, 2005. Pierratos, 2001)



Improved Pulmonary Function & Sleep Patterns with Nocturnal & Short Daily Hemodialysis

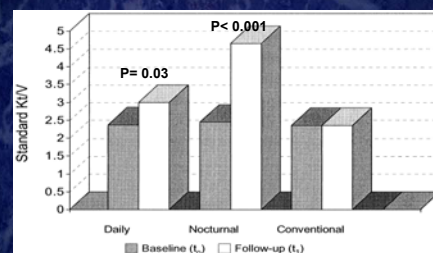
- Significantly less evidence of
 - Restrictive disease
 - Obstructive disease
- Improvement in sleep patterns
central > obstructive or mixed
- Improvement in cognitive
function

(Hanly, et al, 2001, Friedman, 2001 Mahmoud BL, 2004,)



Urea Kinetics DHD – NHD - CHD

NHD vs DHD P<0.001



Suri et al, Am J Kid Dis, 2003



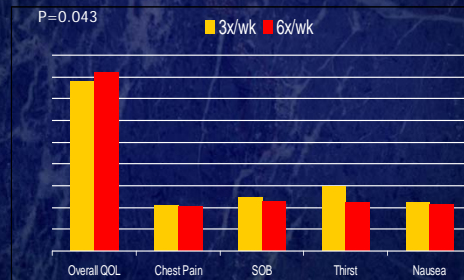
Concentration Changes Pre – Post Dialysis CHD vs DHD

Daily Dialysis
Less Pre-Post concentration changes

Less hemodynamic instability

Williams et al, 2004

Symptoms Between Treatments Conventional VS. Daily Dialysis



Williams et al, 2004

Large Molecule Removal Conventional vs. Nocturnal Dialysis

Weekly β_2 - microglobulin removal



Raj DS, 2000

Williams et al, 2004

Frequent Hemodialysis Quality of life

Quality of Life
Does not decrease
with Daily Dialysis

sense of well being

level of energy

appetite

vocational rehabilitation

Williams et al, 2004

Advantages of Frequent Hemodialysis

- Higher weekly solute clearances
- Improved hemodynamic stability and BP control with less medications
- Improved CVD risks
- Improved sleep patterns
- Improved sense of well being, quality of life, and rehabilitation



Advantages of Frequent Hemodialysis Cont..

- Improved appetite / liberalized diet
- Correction of anemia with less EPO
- Improved calcium and phosphorus control



Advantages of Frequent Hemodialysis cont.

- Safe procedure
- No increase in access problems
- Can be done at home
- Does not require a trained helper
- More free day time away from dialysis



Survival Any change with increased frequency ?

Kjellstrand et al 2005

221 patients on SDH- 315 pt yrs

Deaths: 111/1000 pt years 54% of expected

5 year cumulative survival = 63% vs. 32%USRD

0% if > 3 co morbidities

75% if < 3 co morbidities

80% if age < 53 yrs

50% if age > 53 yrs



Frequent Hemodialysis Question ?

Will it be cost effective ?

YES - Decrease in hospital days 8%

YES - Decrease in medication costs

YES - Improved rehabilitation...more patients in the work force

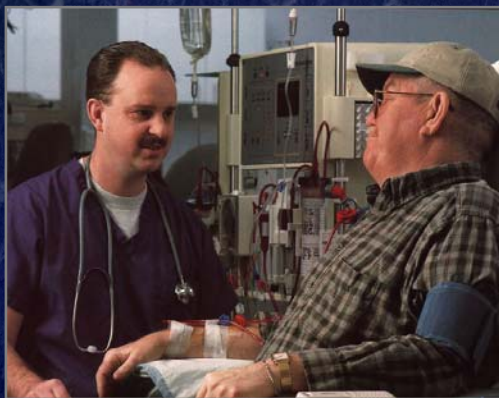
YES self care/home - Decrease in labor costs/overhead

? - Increased supply costs



Frequent/Daily Home Hemodialysis

- New methods of dialysis
 - Easy techniques – less required for preparation and takedown
 - Shorter runs = better fit into lifestyles
 - More stable on dialysis – less fear of complications
 - Decrease exposures promoting inflammation
 - Increase clearance
 - Middle molecules
 - Small molecules



CP14207A




CP14207A-2



Staying Home and Staying Healthy

Frequent Home Hemodialysis

***Decreased*
Oral & Dental Complications**



Thanks!

