Advantages of Nocturnal Dialysis

DTX 19

Jim Curtis
Managing Partner,
Jim Curtis & Associates, LLC

THE UN-PHYSIOLOGY HYPOTHESIS

"We hold this truth to be self-evident in dialysis:

Normal chemistries and physiology are better than abnormal…a lot *better"*

Carl Kjellstrand

DTX19

THE UN-PHYSIOLOGY HYPOTHESIS

First, the more "unphysiologic" dialysis is, and the more abnormal chemistries and fluid levels are before dialysis, the more violently they will change during dialysis and the more ill-effects that patients will experience.

THE UN-PHYSIOLOGY HYPOTHESIS

Secondly, when dialysis is over, the patient's serum potassium level is below normal and the patient is alkalotic and short of fluid in the vascular space. The patient's body is never in a normal state; it is in an abnormal state, both before *and* after dialysis.

In-Center Dialysis Patient Survival

- Has Remained Essentially Unchanged in the Last Decade
- DOQI and KDOQI Have Had Little Impact on Patient Mortality; 23.8% in US Before, 23.6% Now
- HEMO study of 1846 patients on conventional thrice weekly dialysis randomized to receive Kt/V of 1.45 V.S. 1.05 showed ***no improvement*** in survival or hospitalization when dialysis dose was increased.

"The HEMO Study demonstrated unequivocally that inadequate dialysis is no better then poor dialysis" – J Curtis

DTX19

Ideal Dialysis Treatment

- Remove All Toxins
- Restore Electrolyte Balance
- Remove Excess Water
- Correct Alterations in Acid-base Balance
- Maintain Appropriate Po4 levels
- AND….Do This All Without Violent Changes in Electrolyte or Fluid Balances

Frequency of Dialysis

- Dialysis Should Mimic Normal Kidney Function As Best As Possible.
- Must Be As Frequent and Long As Is Possible
- Minimize Interference in the Normal Day to Day Activities of Patients.
- Ideally Then, Dialyzing Overnight Is the Perfect Time

The Nocturnal Regime

- Dialysis for 8 Hours, Six Times a Week
- Dialysis for 8 Hours Every Other Day
- Usually Low Flow Rates: 300 ml/min for Both Blood and Dialysate Is Common.
- Any Dialyzer Works, the Most Common Is Polysulphone

Treatment Parameters

- Normal Prescription Is K- 3, Na 138 Bicarb 32-37, Calcium 3.5 to 4.0
- NA Modeling, UF Profiling Are Not Necessary in Nocturnal Dialysis.
- Phosphorus Sometimes Needs to Be Added to the Dialysate!
- Fistulas, Catheters, and Grafts Can All Be Used. (SND Works Fine)

Outcomes

- Studies in France, Italy, Canada, and More Recently in the US Have Shown:
  - Improved Mortality, As Low As 7%
  - Better Blood Pressure Control, With Significant Reduction in Hypertensive Medication
  - Better Anemia Management With Less EPO
  - Better Calcium - Phosphorus Control, With Less Medication

Outcomes, Cont'

- Studies in France, Italy, Canada, and More Recently in the US Have Shown:
  - Reduction in Patient Hospitalization
  - Reduction in Overall Cost of Caring for Patients
  - Improved Well Being of Patients
  - Better Rehabilitation For Patients.

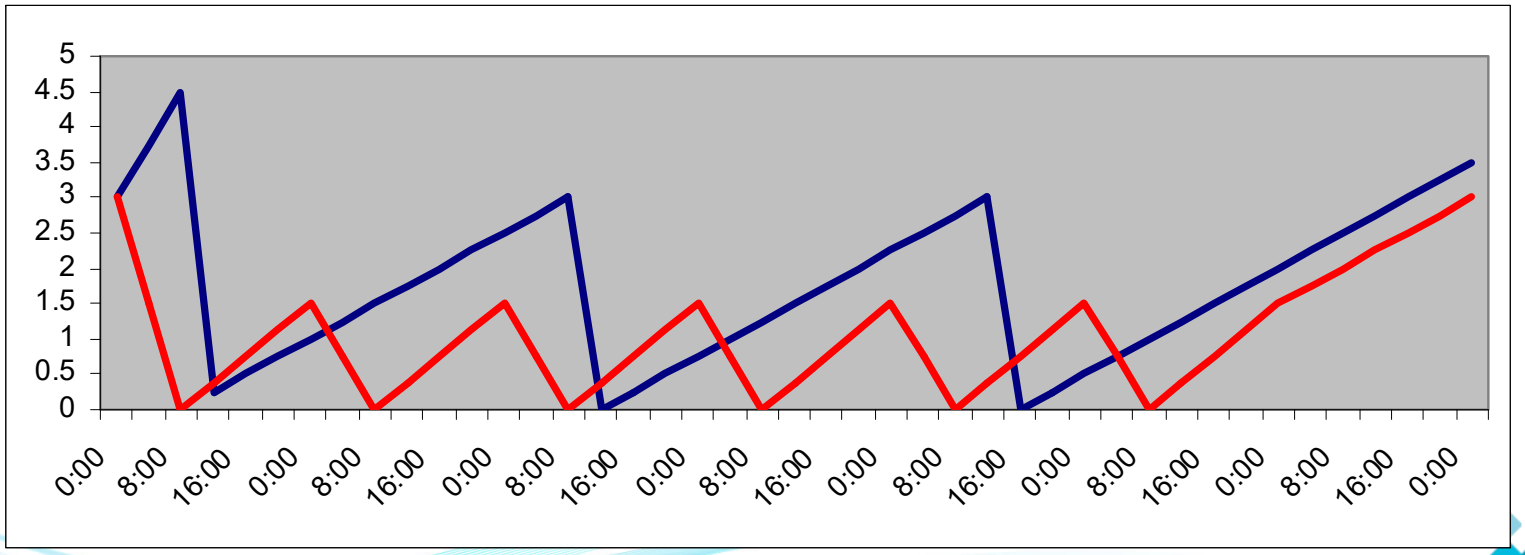
Hypertension Control

- NHD Patients Better Control Hypertension Due to Decreased Intradialytic Weight Gains and Truer EDW's
- Patients in the London study had EDW's drop in the first three months, then increase as real weight increased
- NHD Patients Take up to 70% Fewer Anti-hypertensive Medications

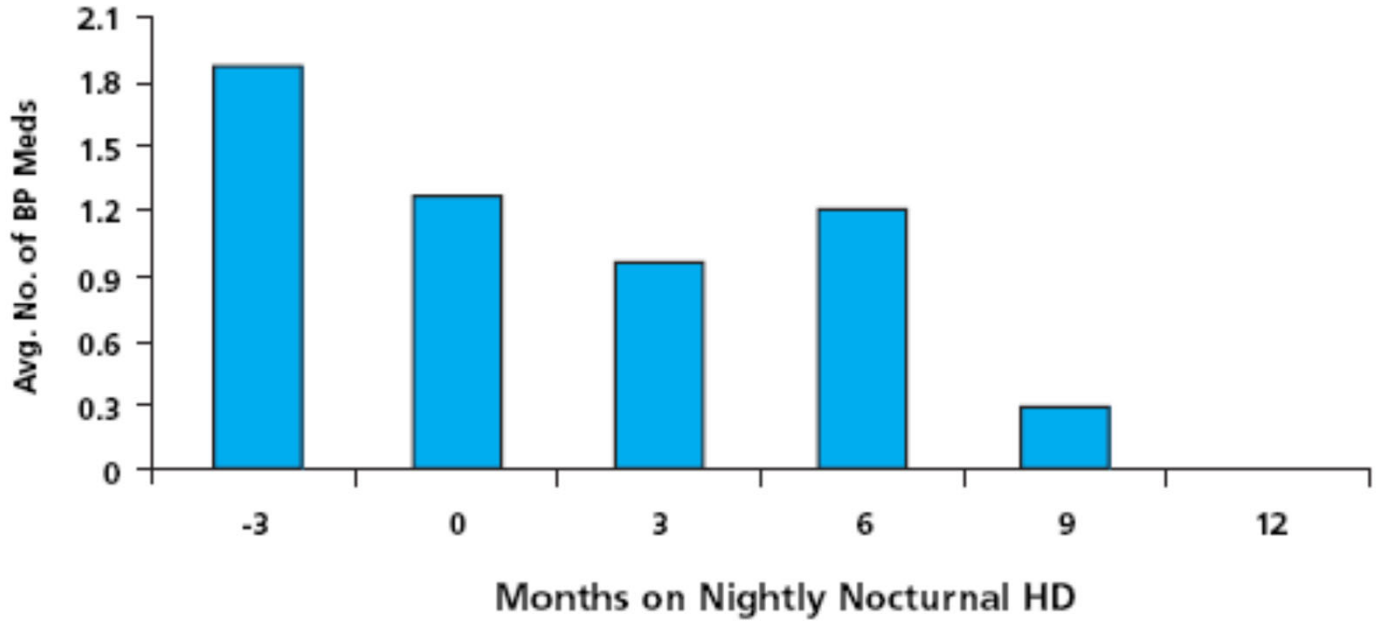
Fluid Management

- Assume an in-center dialysis patient gains 3 liters between treatments, and that fluid removed in four hours
- With the same fluid intake, Nightly Nocturnal patients will gain an 1.5 liters between treatments, and have it removed over an eight hour period.

Weekly fluid consumption and removal



BP Medication Usage is Reduced

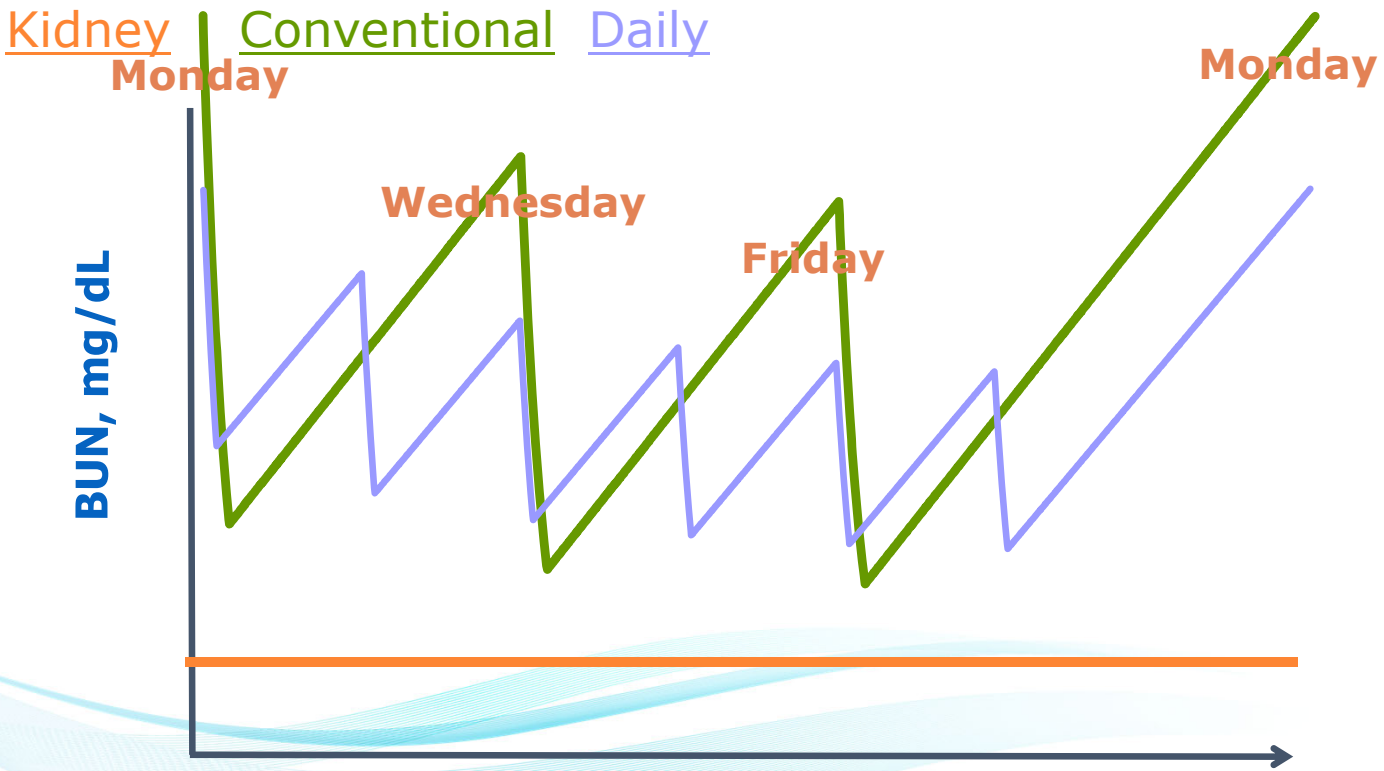


Adapted from Lockridge RM, www.lynchburgnephrology.com/images

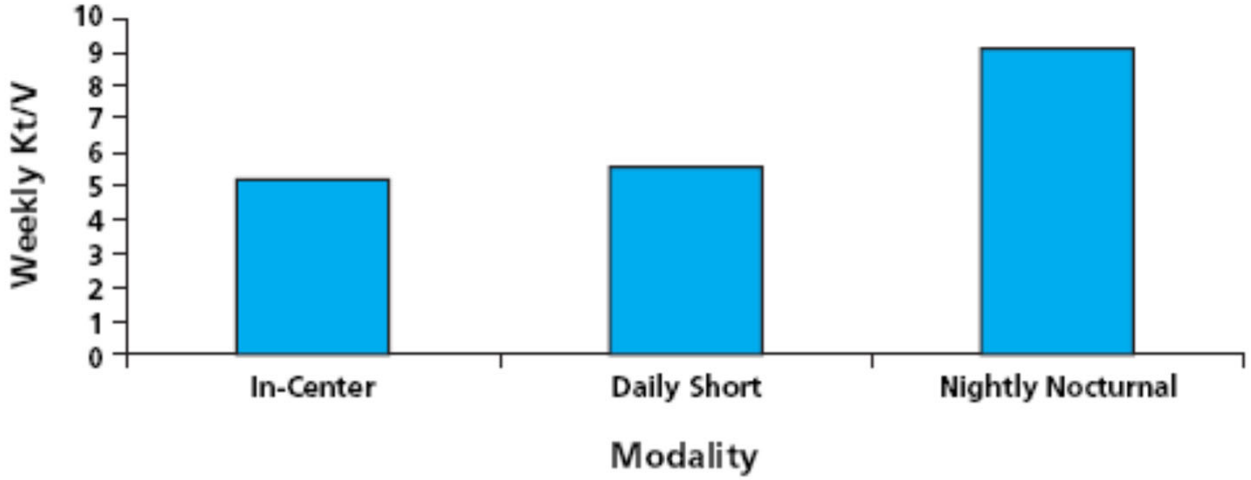
Solute Clearance

- Urea: You Can Achieve a Kt/V Equivalent of Around 1.2 With a 100 cc/min Qb and Qd
- Clearance of Large Molecular Weight Solutes Is Improved Greatly Compared to Regular in Center, or Even Short Daily Dialysis
- Low Phosphorus Can Be a Problem

Urea Generation and Removal Profile



Measured Adequacy of Dialysis



Adapted from Suri R, et al., AJKD, July 2003

Phosphorus

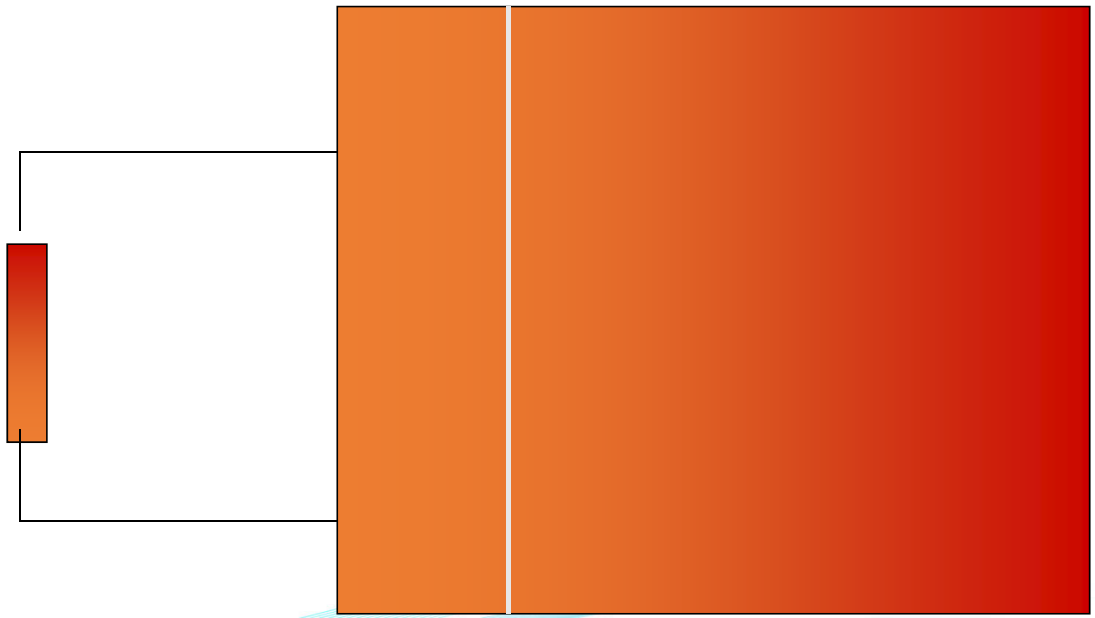
"Trying to remove phosphorus with dialysis is akin to robbing a panhandler outside of a bank rather than the bank itself"

DeSoi CA, Umans JG. Does the dialysis prescription influence phosphate removal? *Semin Dial* 1995; 8(4):201-203.

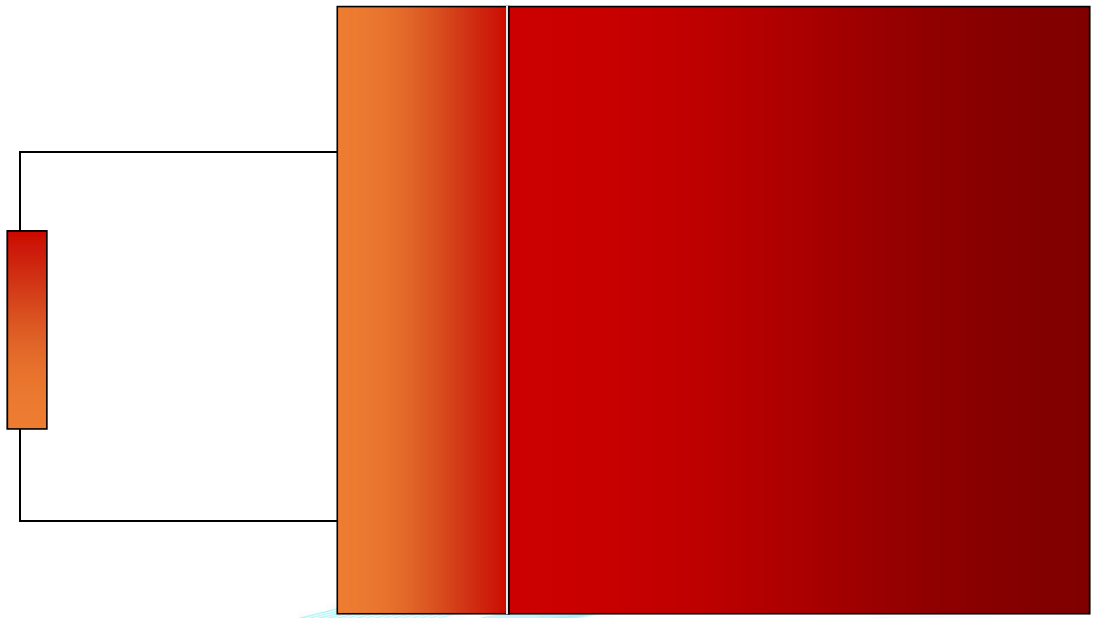
Graham's Law Of Molecular Movement

Solutes with smaller molecular weights diffuse more easily and quickly than larger ones.

Small Molecule Removal During Dialysis



Large (or slow) Molecule Removal During Dialysis



The Precipitation Process

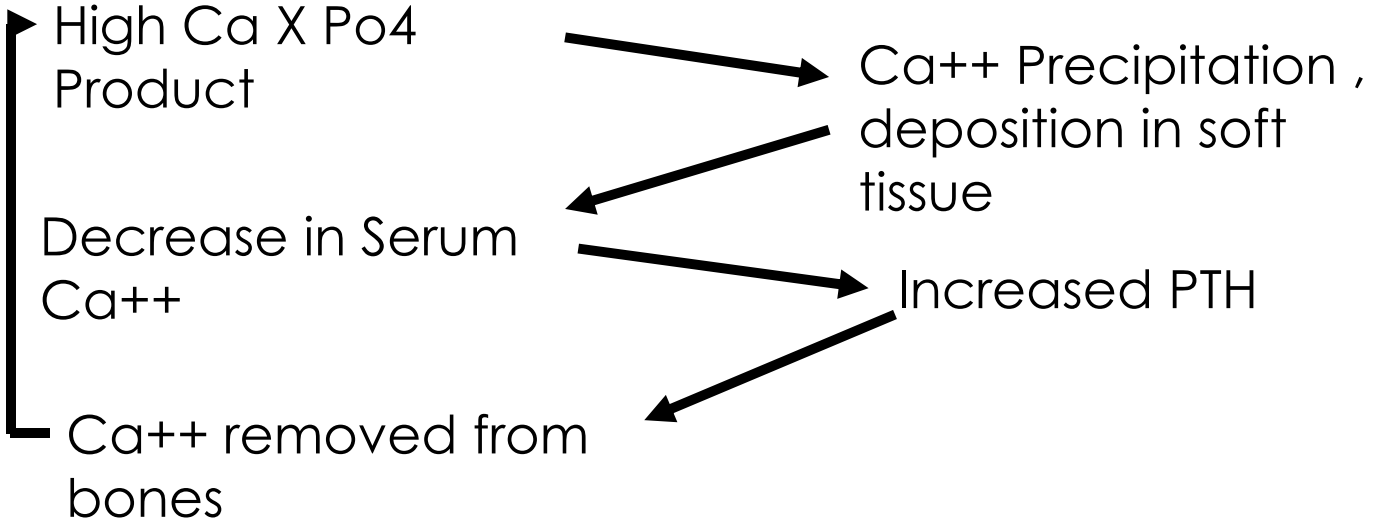
No actual soft tissue was damaged in the development of this demonstration

The Precipitation Process

The Precipitation Process

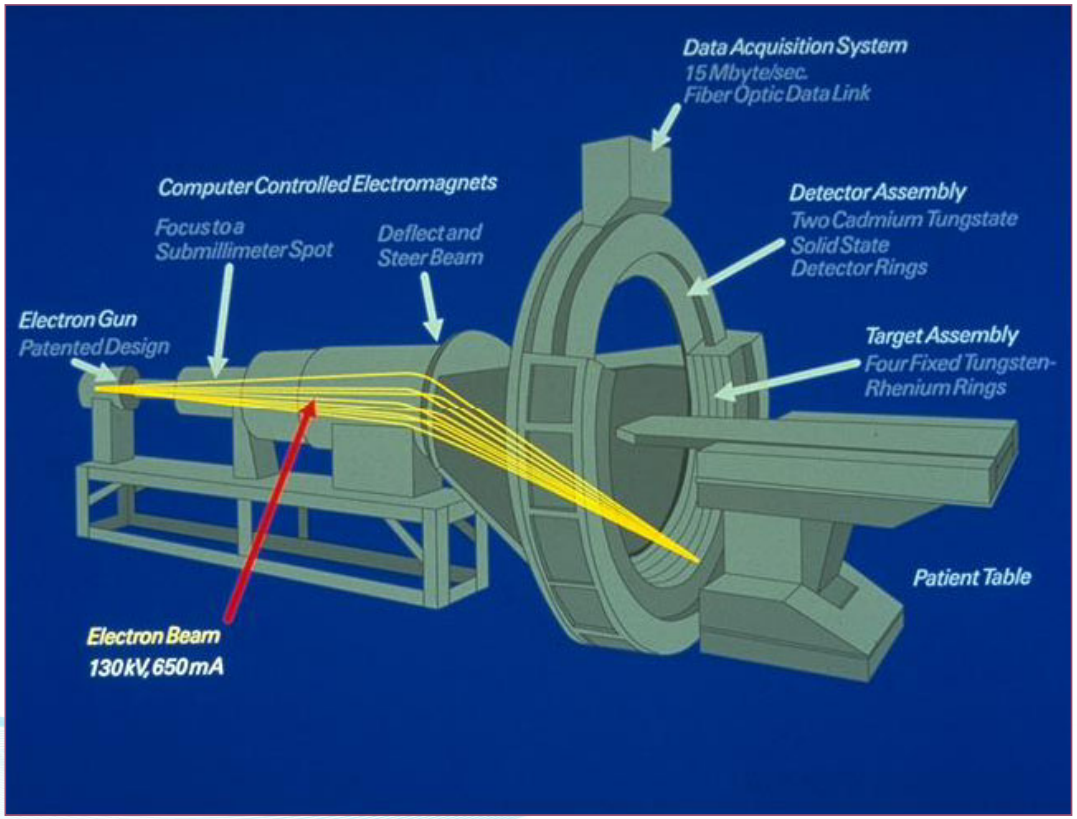
The Precipitation Process

The Vicious Cycle of Phosphorus



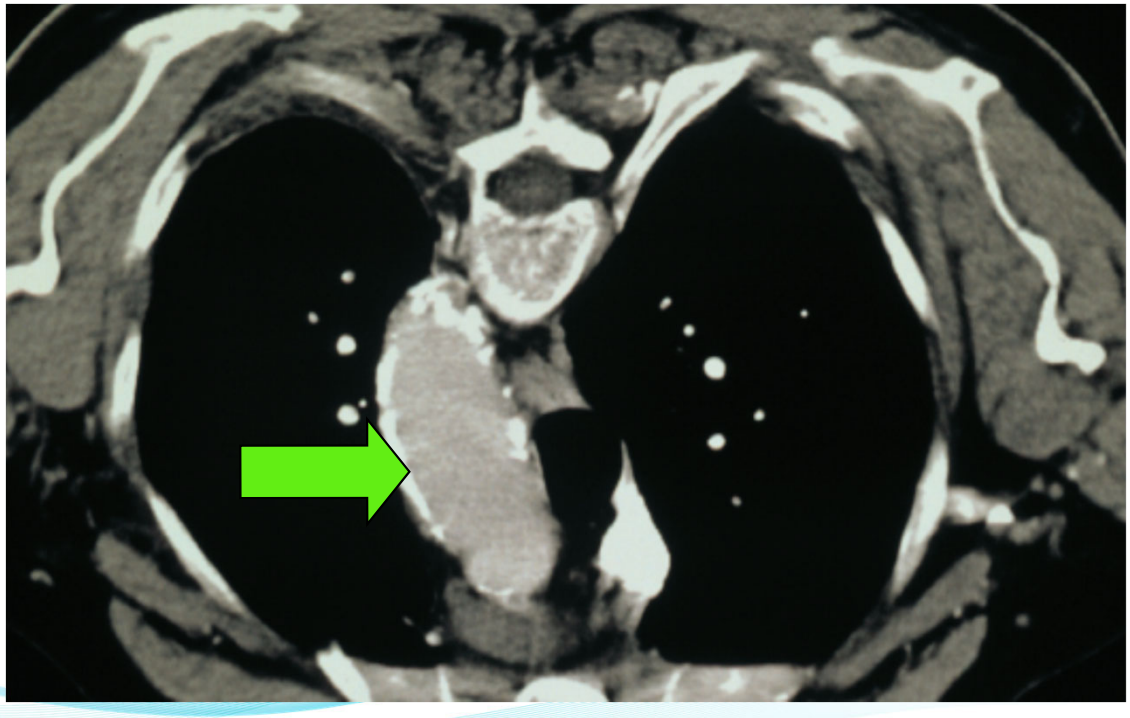
As long as there is too much phosphorus in the blood stream, calcium will be constantly removed from the bones, where it is needed, and deposited in soft tissue, where it is harmful.

Electron Beam Computed Tomography (EBCT)



Slide courtesy of P. Raggi.

Aortic arch calcification



Courtesy of Dr D Goldsmith

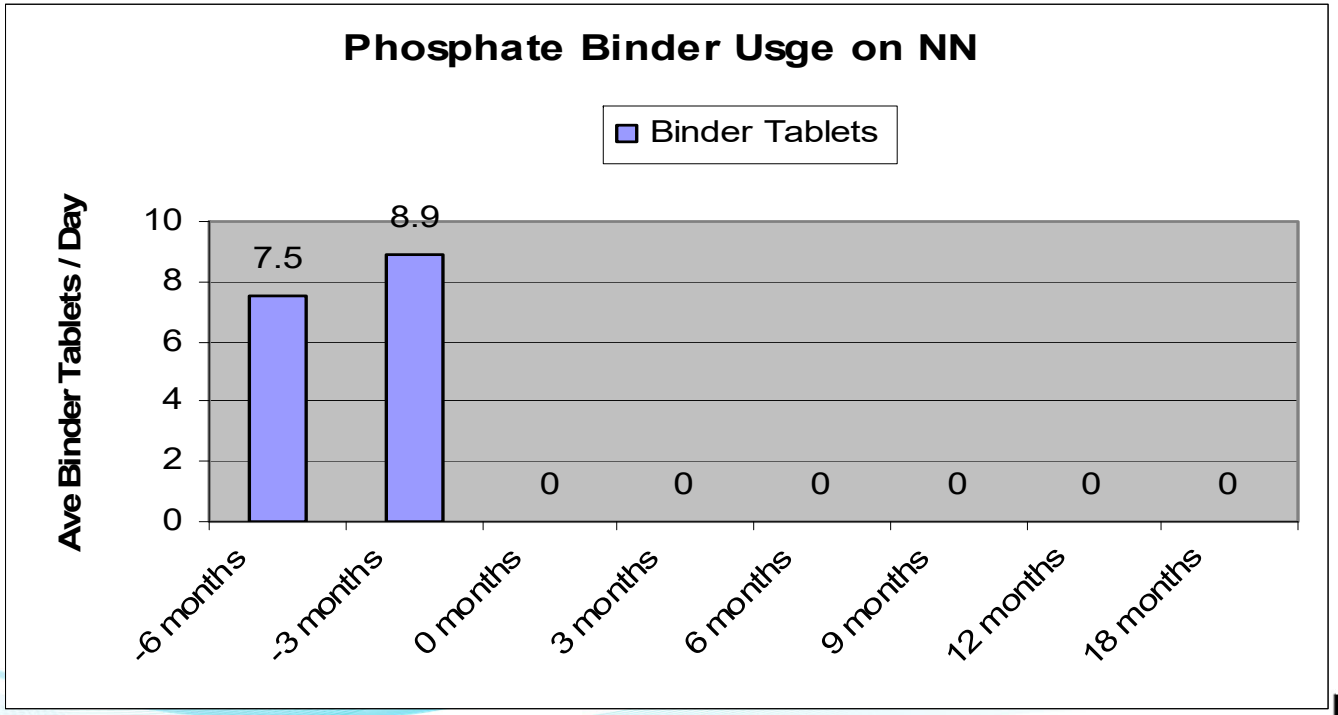
EBCT Scores and CV Risk

Mayo Clinic EBCT Guidelines[1]

EBCT Score	Plaque Burden	Implication for CV Risk
<10	Minimal	Low
11-100	Definite, Mild	Moderate
101-400	Definite, Moderate	High
>400	Extensive	Very High

1. Rumberger JA, et al. *Mayo Clin Proc*. 1999;74:243-252.

Phosphate Binders in the Lynchburg Study

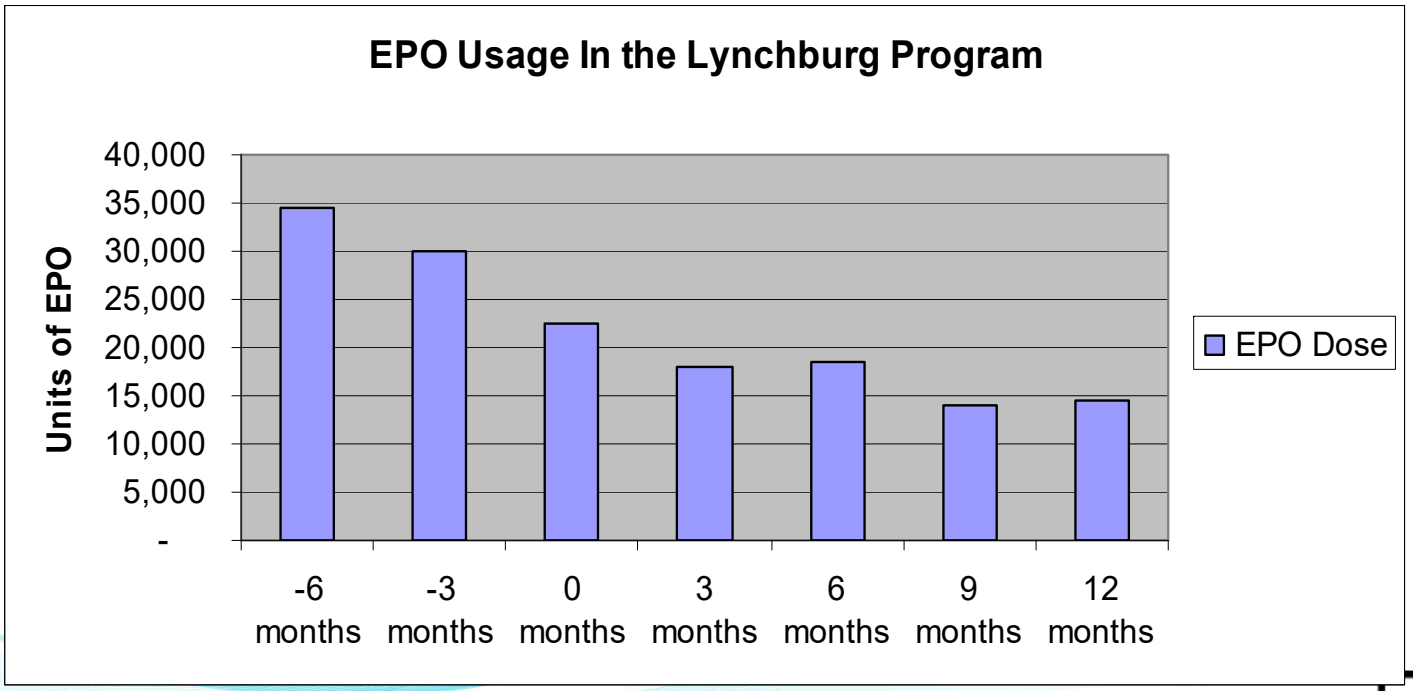


Adapted from Lockridge R, et al., Semin Dial, Nov.-Dec. 1999.5

Anemia Management

- A Less Uremic State Leads to a Longer Red Blood Cell Life
- The Need for EPO Often Decreases Considerably With Patients Undergoing HNHD

Improving Anemia Management



Adapted from Lockridge R, et al., Semin Dial, Nov.-Dec. 1999.5

Quality Of Life

- Patients Report Significant Improvement in Sense of well being
- Within Two Weeks, Patients Report A Decrease In:
  - Anorexia
  - Sleep Disorders
  - Restless Leg Syndrome
- Psychological Testing Shows Improved Cognitive Function

No More "Washed Out" Feeling

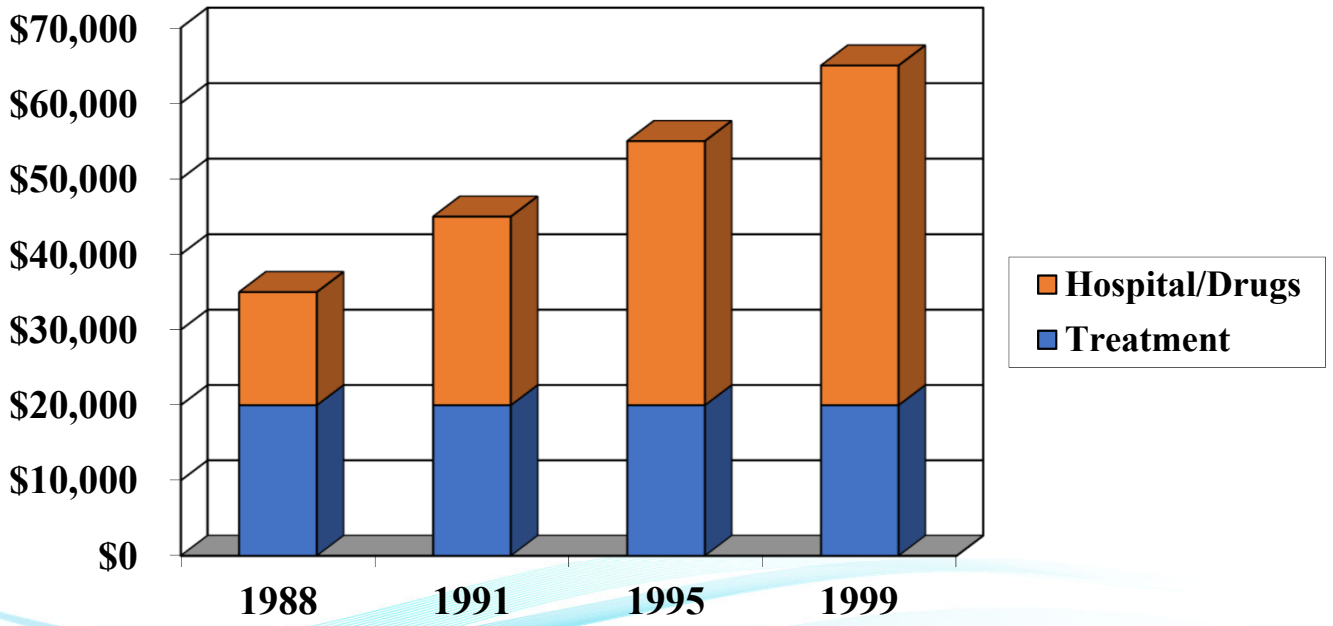
Modality	Baseline	3 Months	18 months
Daily	327 +/- 203.2	22.0 +/- 30.4 *	29.8 +/- 44.1 *
Nightly	647.5 +/- 584.4	5.0 +/- 17.3 *	7.5 +/- 15.0
Control	375 +/- 460.9	419.8 +/- 414.7	396.9 +/- 394.9 *
* denotes P<.05			

Weekly Treatment Costs

	IHD	HNHD
Staff	$423	$210
Direct Materials	$126	$318
Drugs	$231	$172
Overhead	$238	$80
Physician Fees	$128	$128
Admits/Procedures	$134	$23
Depreciation	$17	$118
Lab Tests/ Imaging	$26	$33
TOTAL	$1,332	$1,082

Adapted from McFarlane PA, et al., Kidney Int, Vol. 62, 2002.

Annual Per Patient Treatment Costs



Summary

- Nocturnal Hemodialysis Has Many Advantages
  - Higher Weekly Solute Clearances
  - Improved Hemodynamic Stability
  - Improved Blood Pressure Control with Less Medication
  - Correction Of Anemia with Lower EPO Requirements

Summary

- Nocturnal Hemodialysis Has Many Advantages 2
  - Improved Sleep Patterns
  - Improved Sense of Well-Being, Quality Of Life, and Rehabilitation
  - Improved Calcium and Phosphorus Control
  - Improved Appetite and Liberalized Diet

Summary

- Nocturnal Hemodialysis Can Be Done Safely At Home
  - Does Not Require a Trained Helper (for everyone)
    - Most Programs do Prefer It
- Access Problems Slightly More Frequent Than with In-Center Dialysis With Daily Dialysis
- Overall Costs to Payor Lower

Summary

NORMAL IS BETTER THAN ABNORMAL.

The “Unphysiology Hypothesis ”

Kjellstrand CM, Evans RL, Petersen RJ, Shideman JR, von Hartitzsch B, Buselmeier TJ. The “unphysiology" of dialysis: A major cause of dialysis side effects? Kidney Int 1975; Suppl 2:30-4

jimcurtis803@gmail.com

DTX19