# Dialysate Composition

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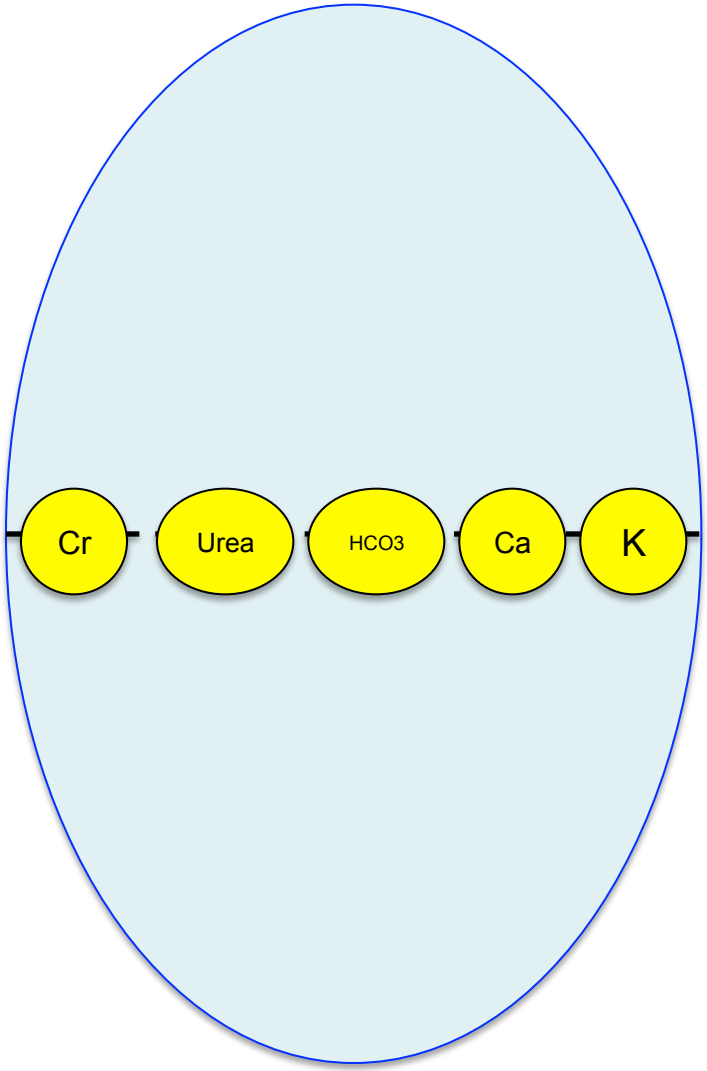
# The function of dialysis fluid

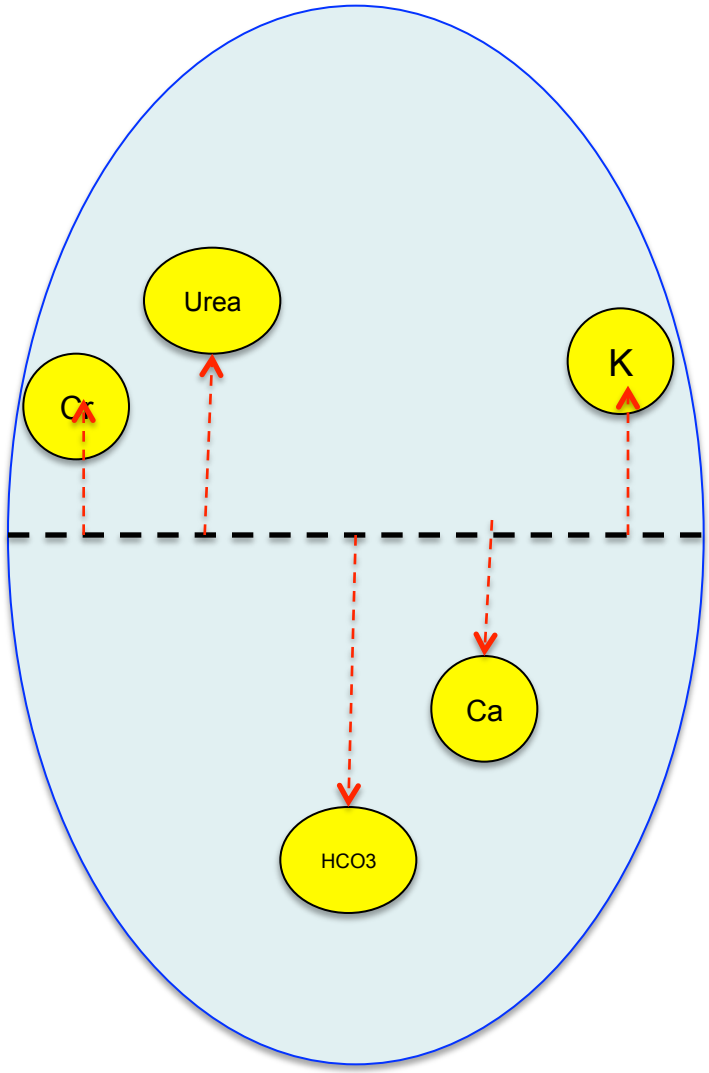
To correct the chemical composition of uremic blood to normal physiological levels.

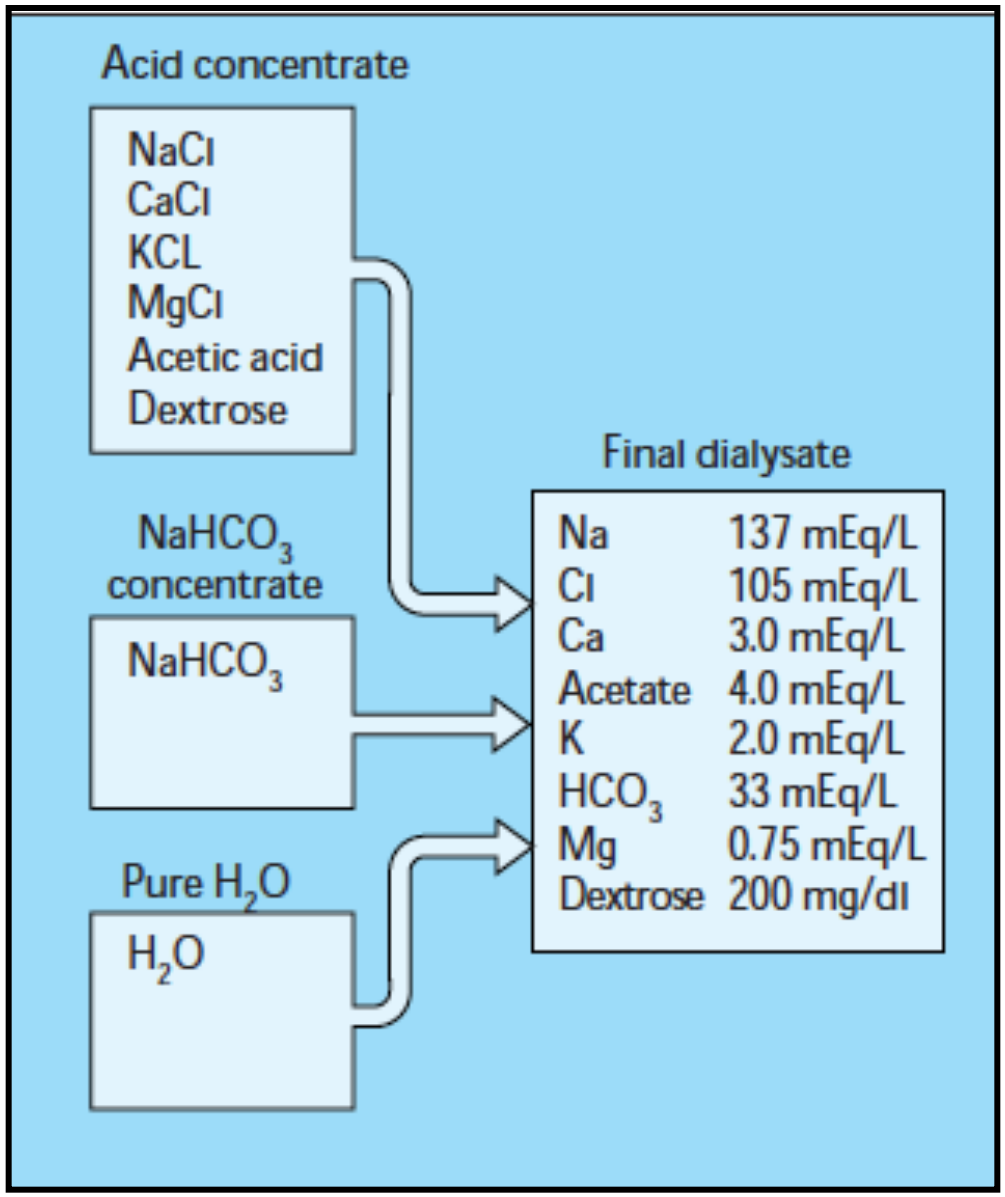
- To remove waste product
- To remove electrolytes in excess
- To restore acid - base balance

In normal people




In kidney failure



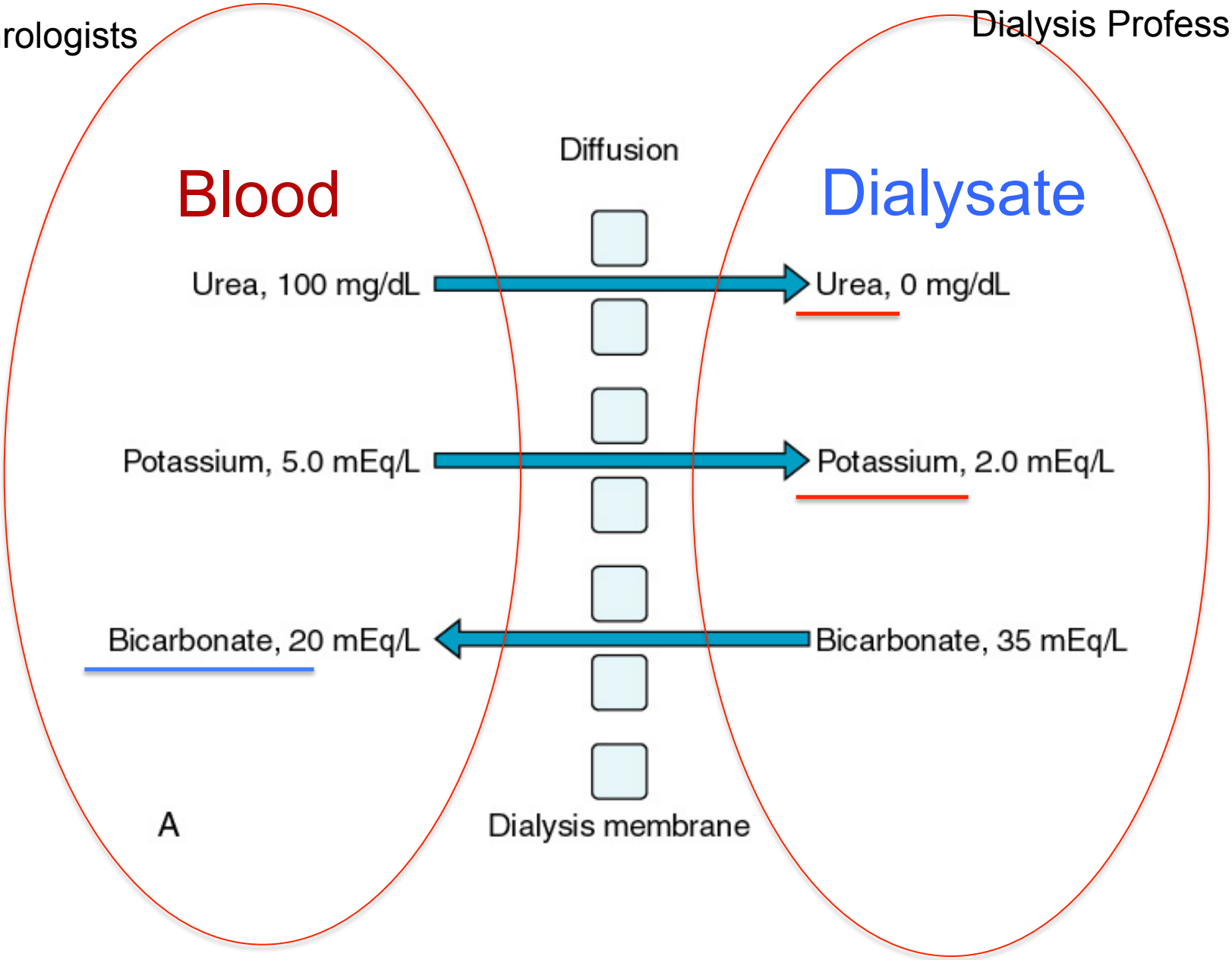



## COMPOSITION OF A COMMERCIALLY AVAILABLE PERITONEAL DIALYSATE

| Solute | Dianeal PD-2 |
|---|---|
| Sodium, *mEq/L* | 132 |
| Potassium, *mEq/L* | 0 |
| Chloride , *mEq/L* | 96 |
| Calcium , *mEq/L* | 3.5 |
| Magnesium, *mEq/L* | 0.5 |
| D, L-Lactate, *mEq/L* | 40 |
| Glucose, *g/dL* | 1.5, 2.5, 4.25 |
| Osmolality | 346, 396, 485 |
| pH | 5.2 |

Nephrologists

Dialysis Professionals

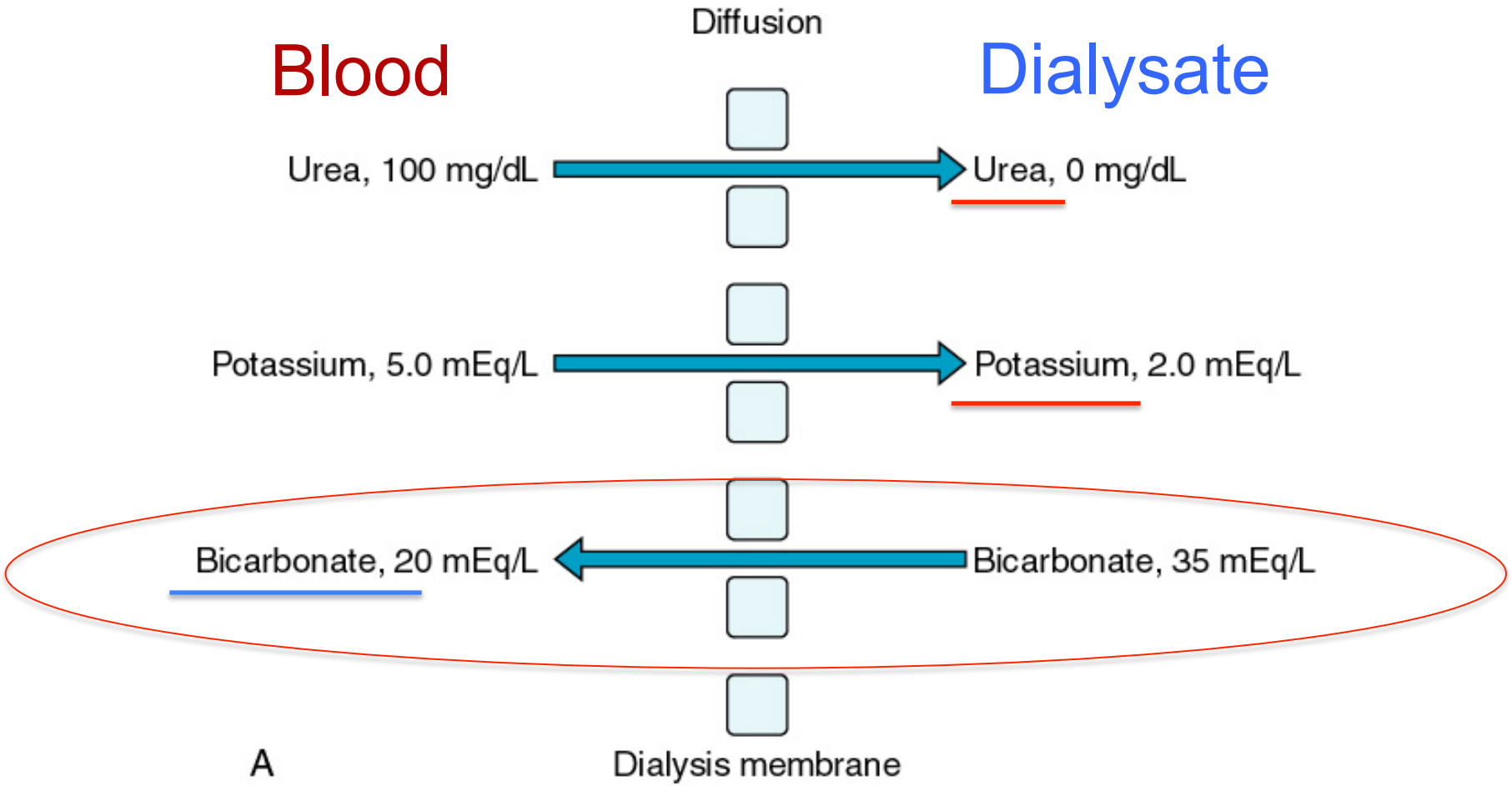



Take and Give

# Bicarbonate in dialysate

# Buffers in the body & in dialysis fluid

- Natural buffers in the body
- Disturbance of buffers in ESRD
- Correction of acid-base balance by hemodialysis.


Diffusion
Blood
Dialysate
Urea, 100 mg/dL
Urea, 0 mg/dL
Potassium, 5.0 mEq/L
Potassium, 2.0 mEq/L
Bicarbonate, 20 mEq/L
Bicarbonate, 35 mEq/L
A
Dialysis membrane

# Acetate versus Bicarbonate

## Side effects

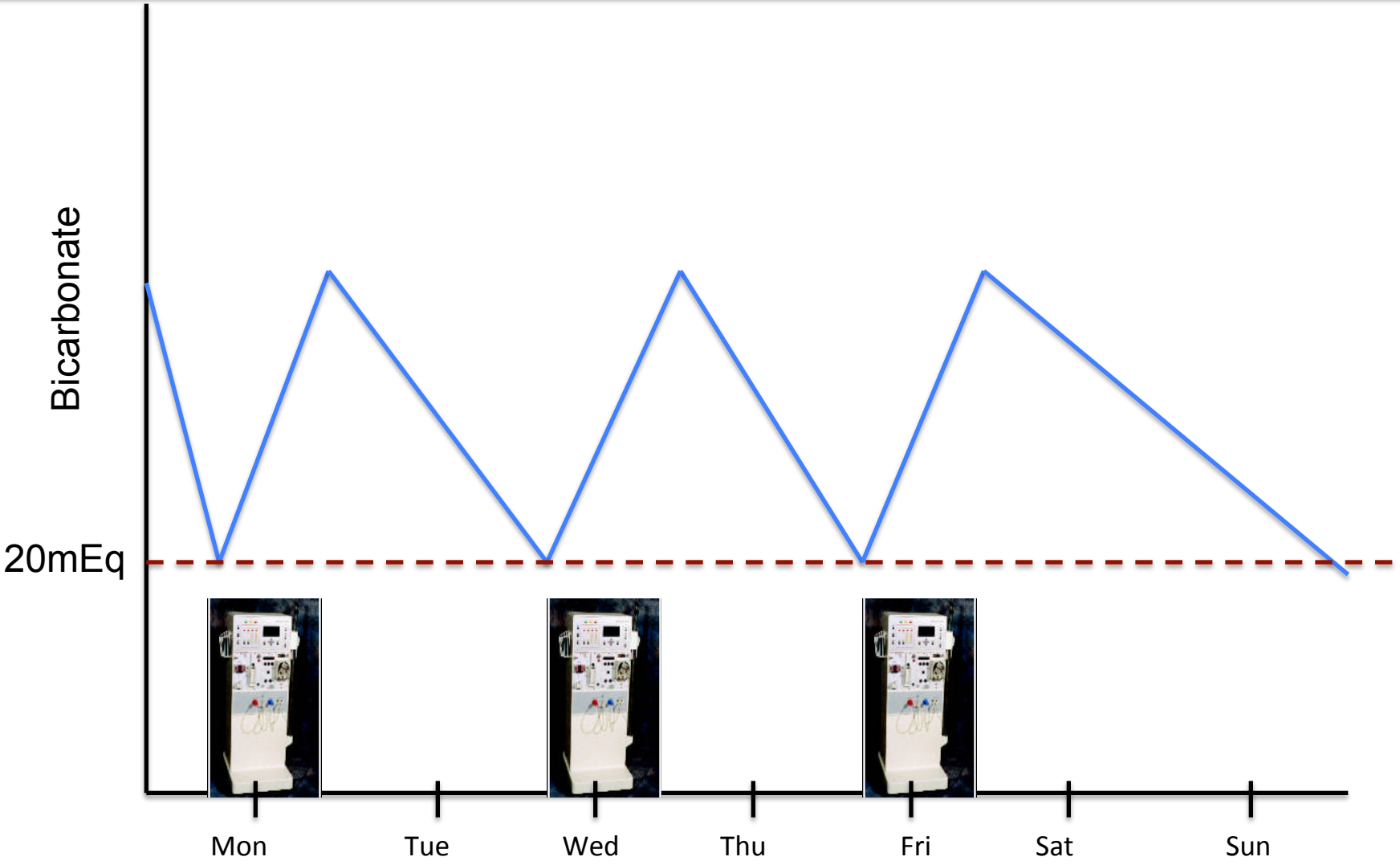
| Acetate Dialysis | Bicarbonate Dialysis |
| --- | --- |
| • Hypotension | |
| • Nausea | none |
| • Vomiting | |
| • Fatigue | |

# Benefits of using Bicarbonate dialysis

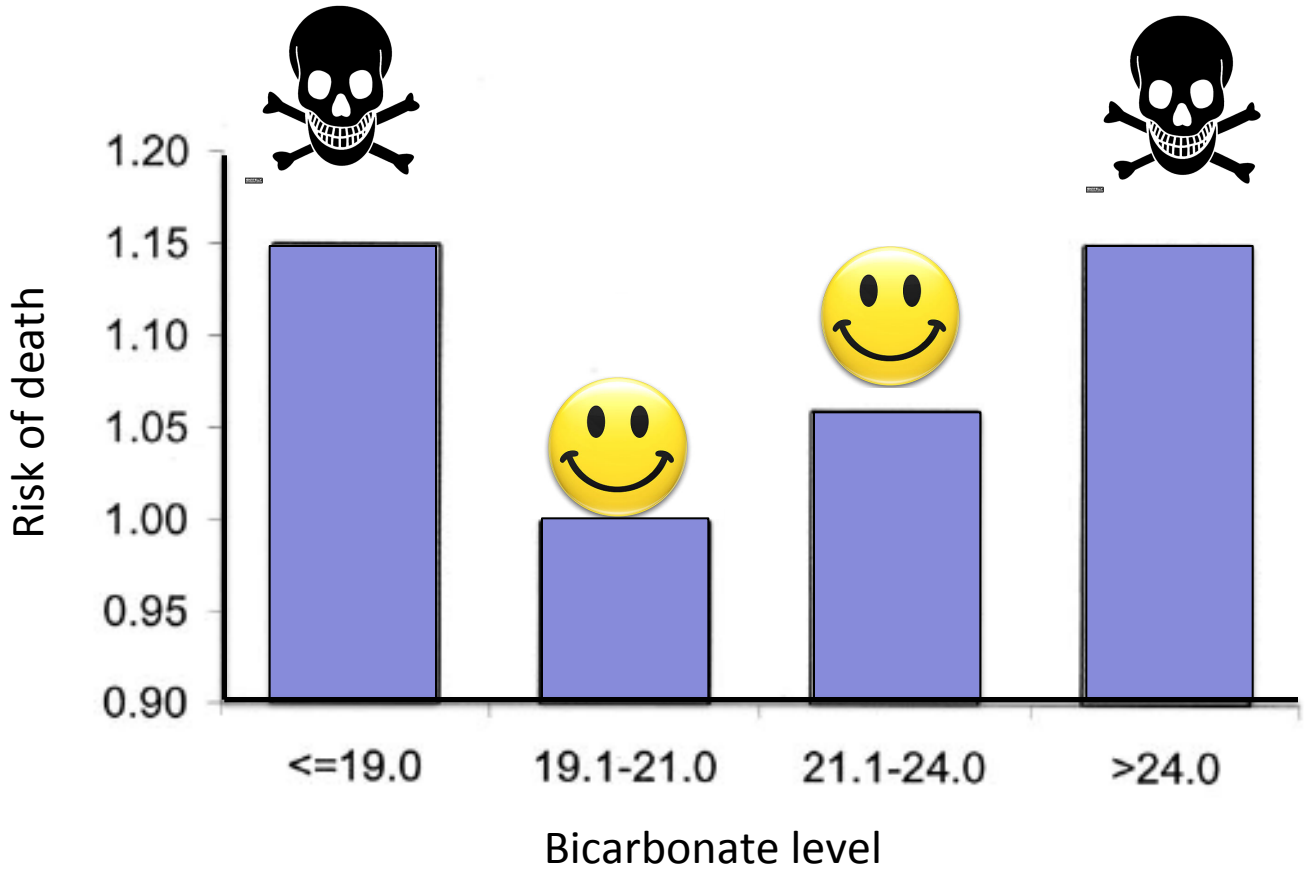
**Benefits from using bicarbonate in dialysis**

| | | |
|---|---|---|
| **acute benefits:** | + no vasodilation | mainly due to lack of acetate |
| | + better fluid management | |
| | + normal blood gases and breathing | |
| | + no unphysiological accumulation of metabolites | |
| | + better phosphate removal | |
| | + less cytokine induction | |
| | + better correction of acidosis | |
| **long-term benefits:** | + normalized acid-base balance | mainly due to normalized acid-base balance |
| | + normalized protein metabolism | |
| | + optimized body weight | |
| | + fewer long-term complications | |

# Bicarbonate and dialysis



# Acidosis correction prevents death



# Acidosis correction improves nutritional status

Serum Bicarbonate 14

Serum Bicarbonate 23

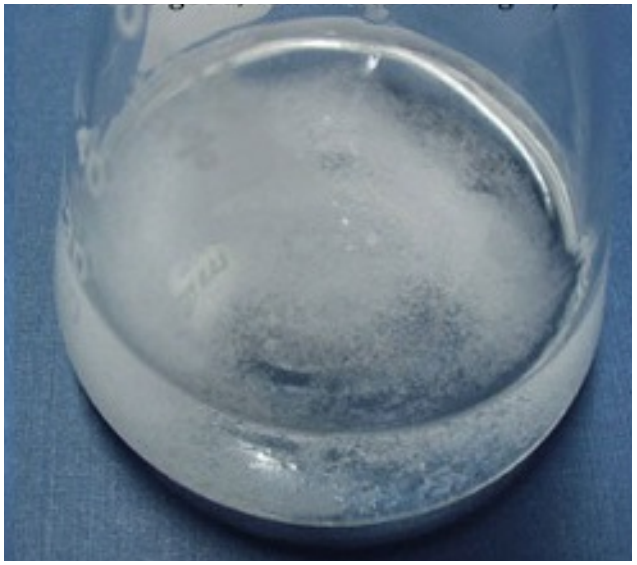
# Dialysate buffer: Is future in citrate?

# Potential benefits of Citrate dialysate

- Improves dialysis dose (less fiber clotting)
- Decrease general anticoagulation needs
- Allows heparin-free dialysis
- Decreases blood pressure
- Decreases ionized Ca
- Decreases Magnesium?

# Sodium in dialysate

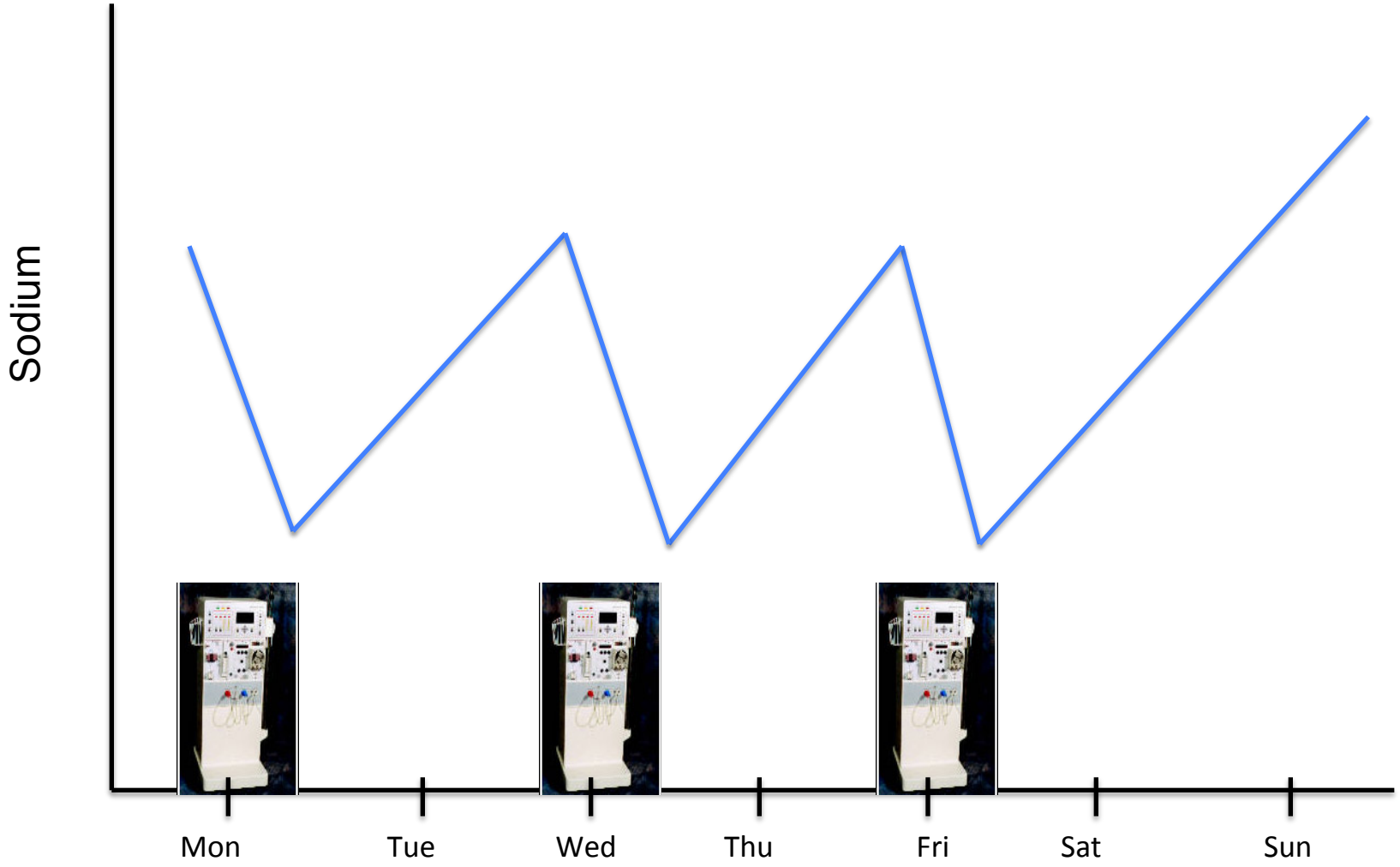
# What happens when you place some salt on a plate?



Sodium = Conductivity

Conductivity 14 = Sodium 140mEq/L

# Salt and dialysis
## (Salt+water+BP)



# Sodium removal helps in

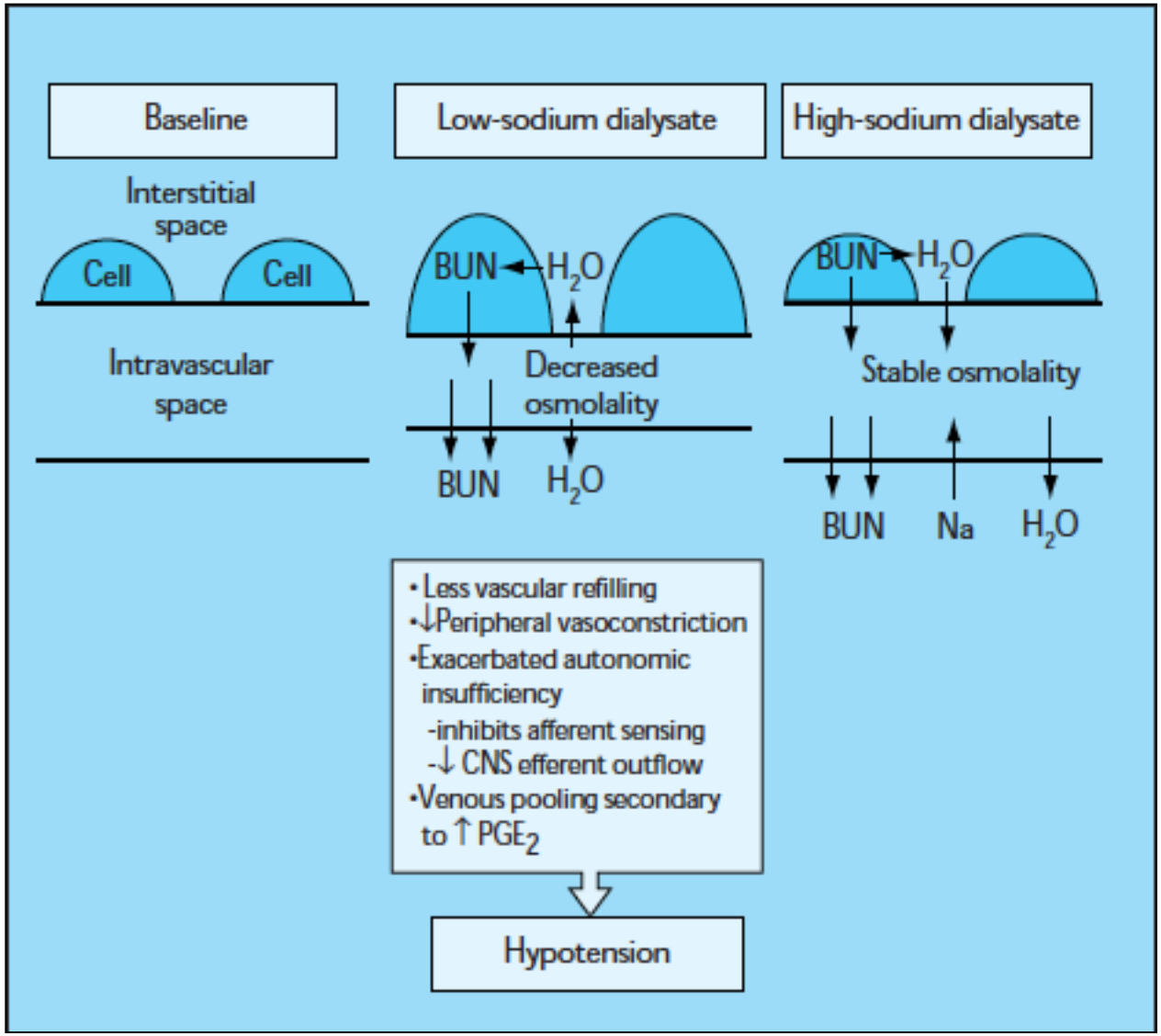
Sodium removal ⟶

Sodium improvement

Water removal,

BP improvement,

# Sodium ramping



# INDICATIONS AND CONTRAINDICATIONS FOR USE OF SODIUM MODELING (HIGH/LOW PROGRAMS)

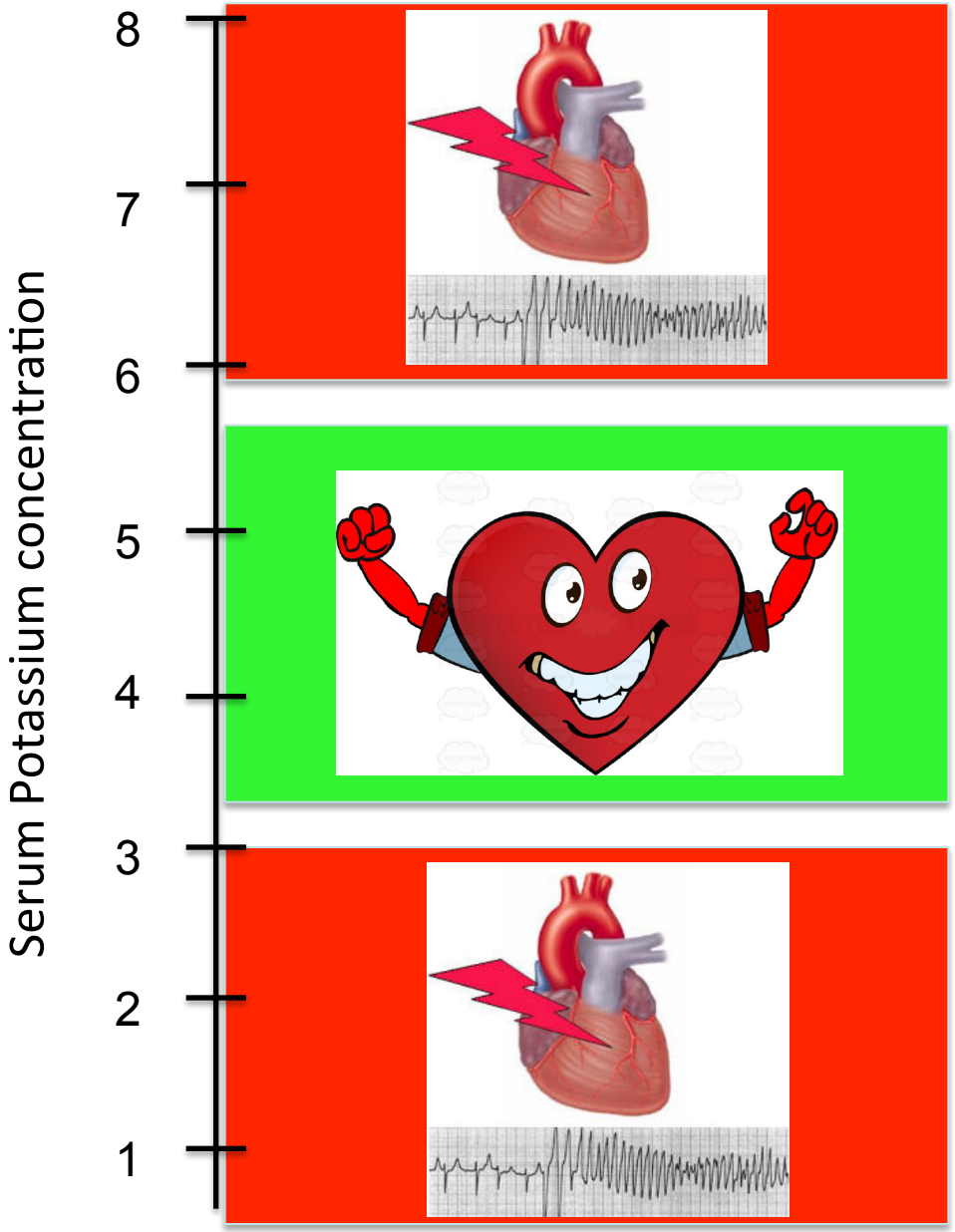
Indications

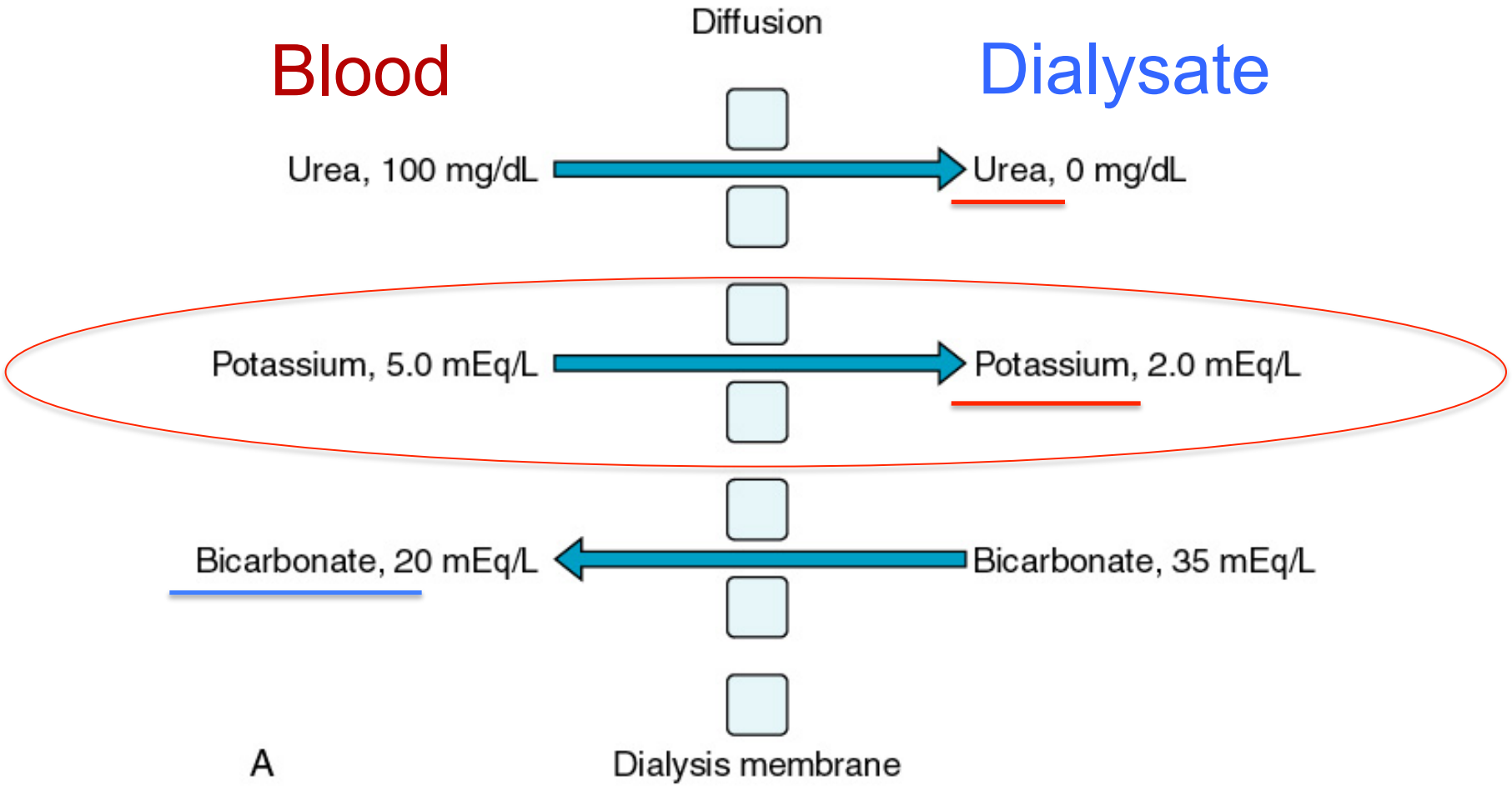
- Intradialysis hypotension
- Cramping
- Initiation of hemodialysis in setting of severe azotemia
- Hemodynamic instability (*eg*, intensive care setting)

Contraindications

- Intradialysis development of hypertension
- Large interdialysis weight gain induced by high-sodium dialysate
- Hypernatremia

# Potassium in dialysate


Serum Potassium concentration
8
7
6
5
4
3
2
1


Diffusion
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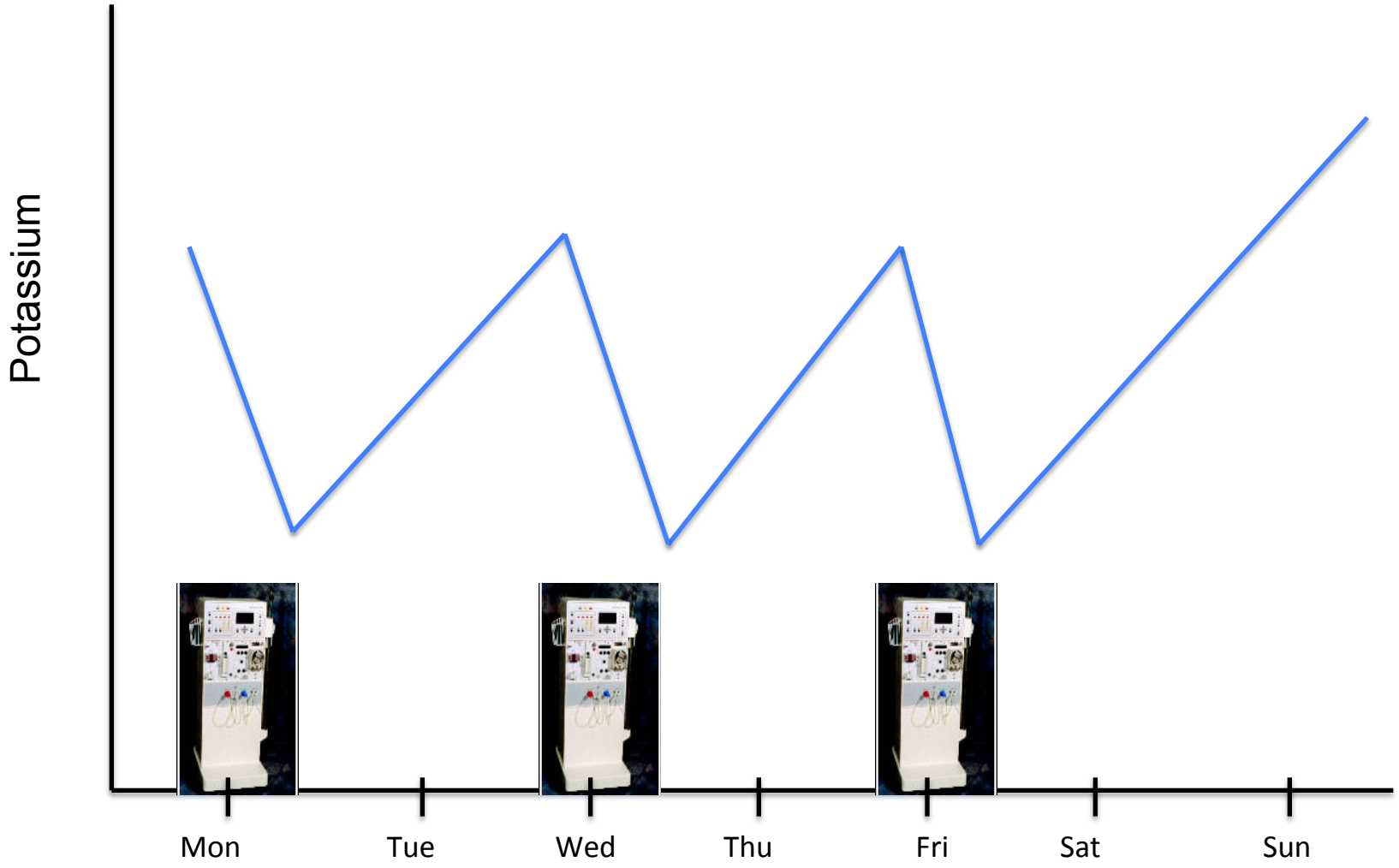
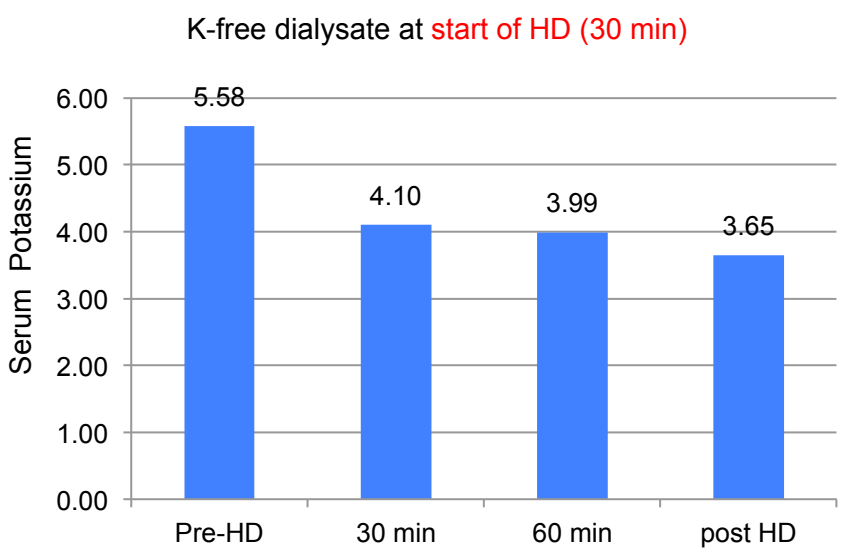
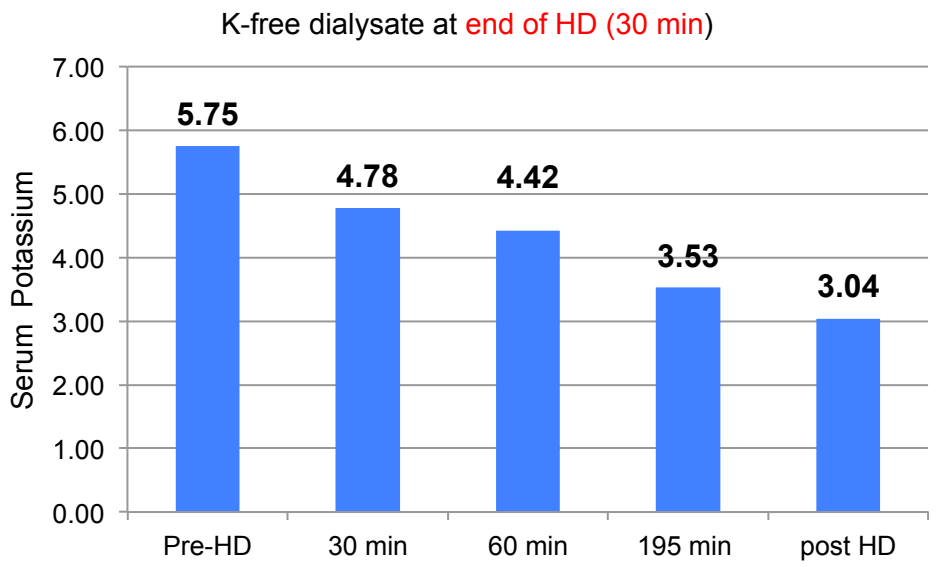
Dialysis membrane

# Potassium and dialysis



# What do you do when a patient comes with a K of 7?

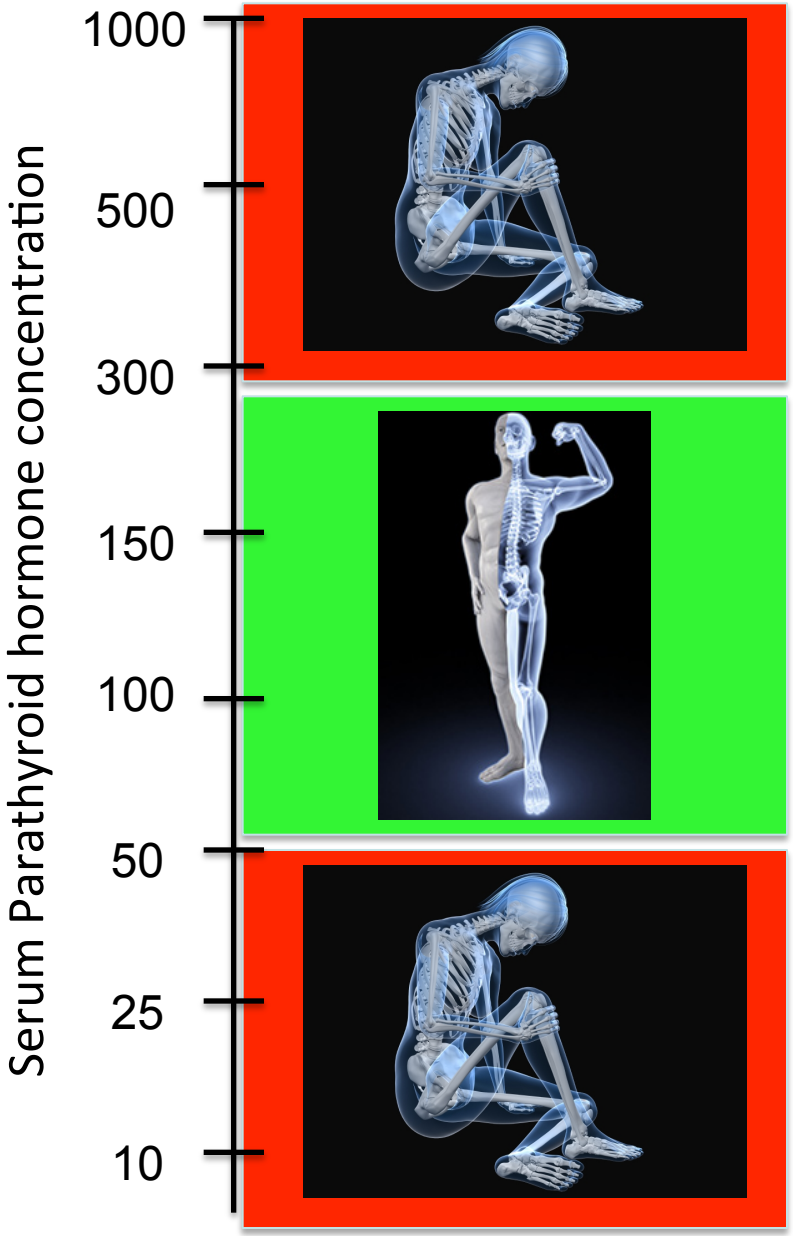



Apex Database

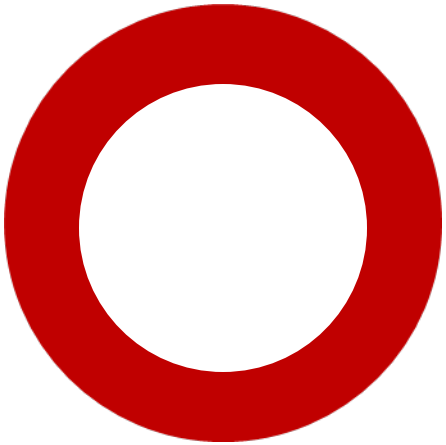
# Calcium in the dialysate

# Relation between Calcium and Bone health


Serum Parathyroid hormone concentration
1000
500
300
150
100
50
25
10

# Relation between  Ca and BP

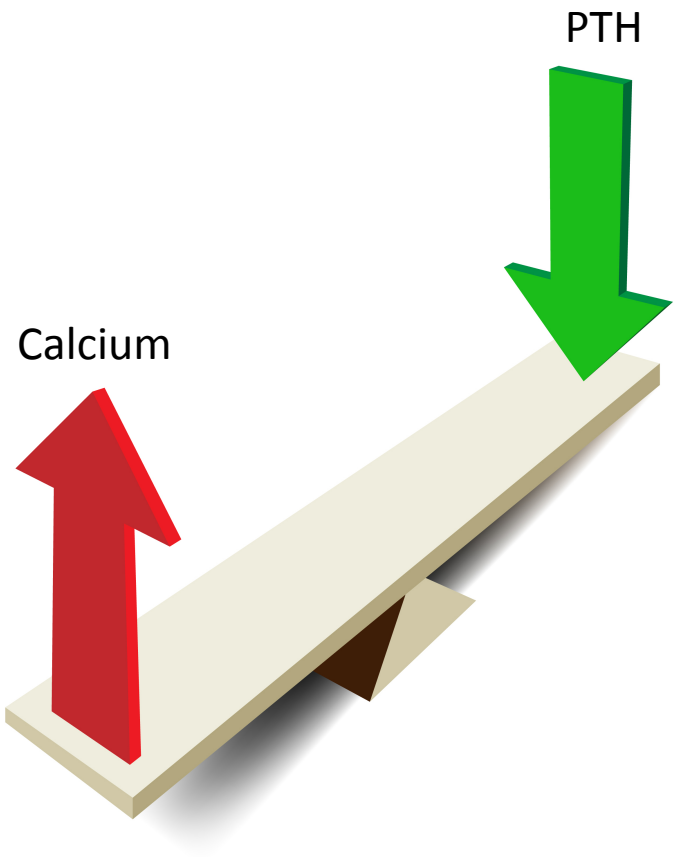
Low calcium dialysate



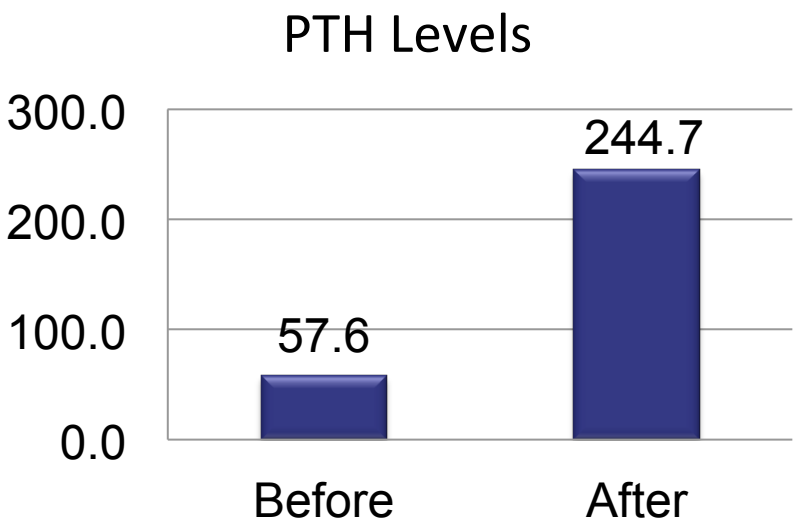
↓ BP

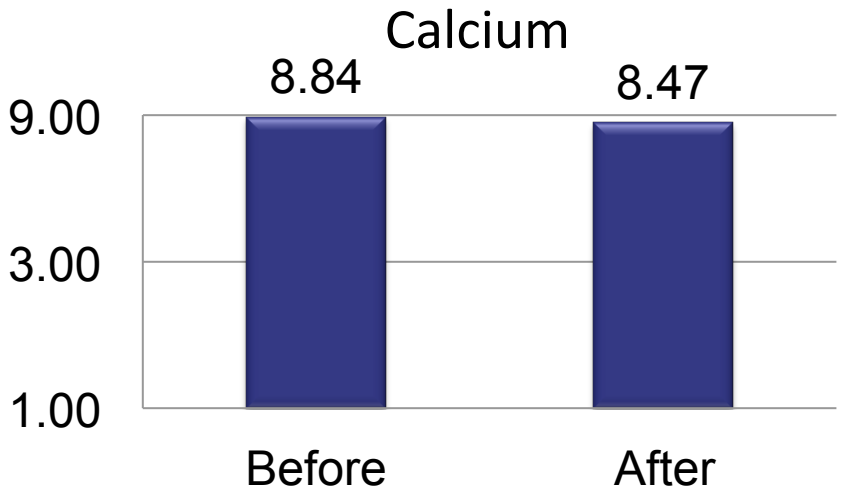
# You can modify the Calcium in the dialysate for

- Strengthening bones
- Controlling BP
- Improving quality of life



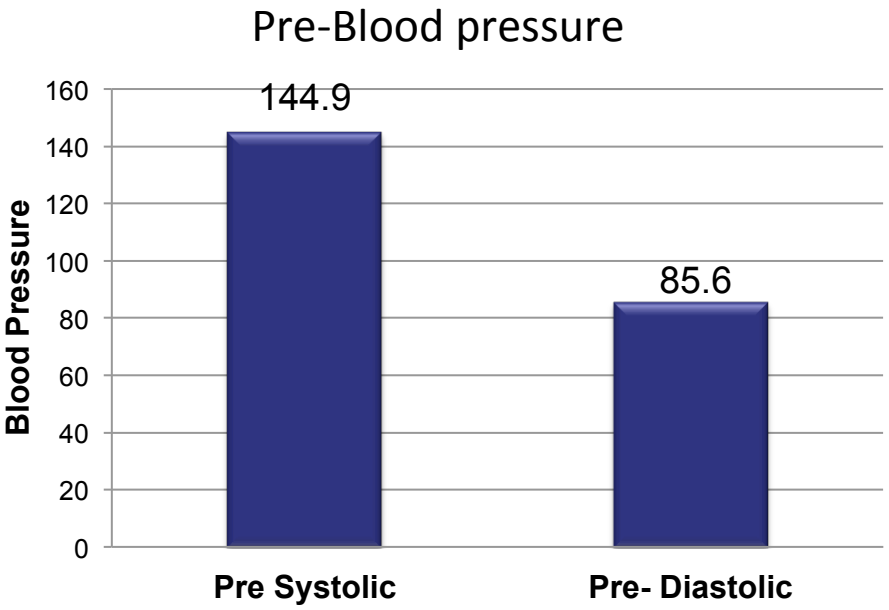
# Using low Calcium dialysate to improve bone heath

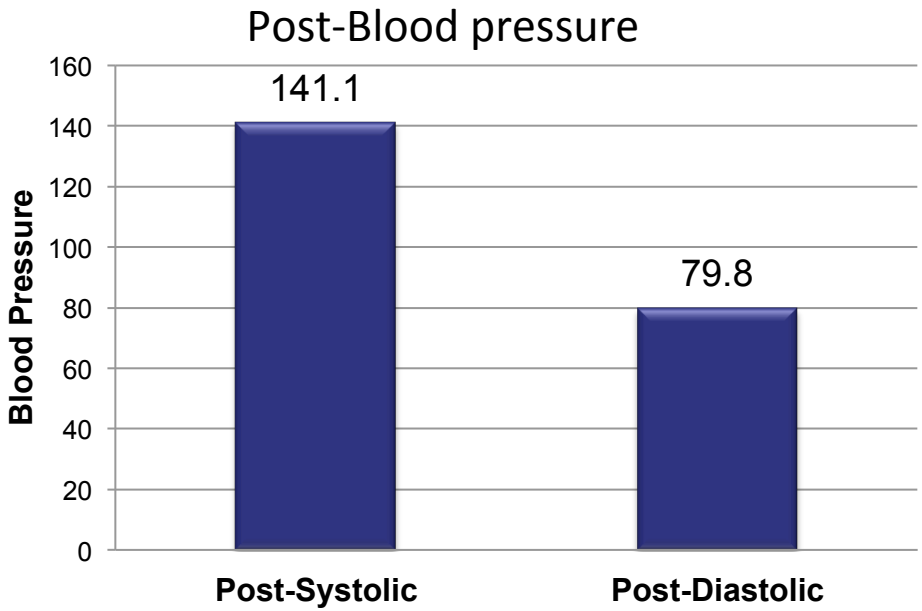


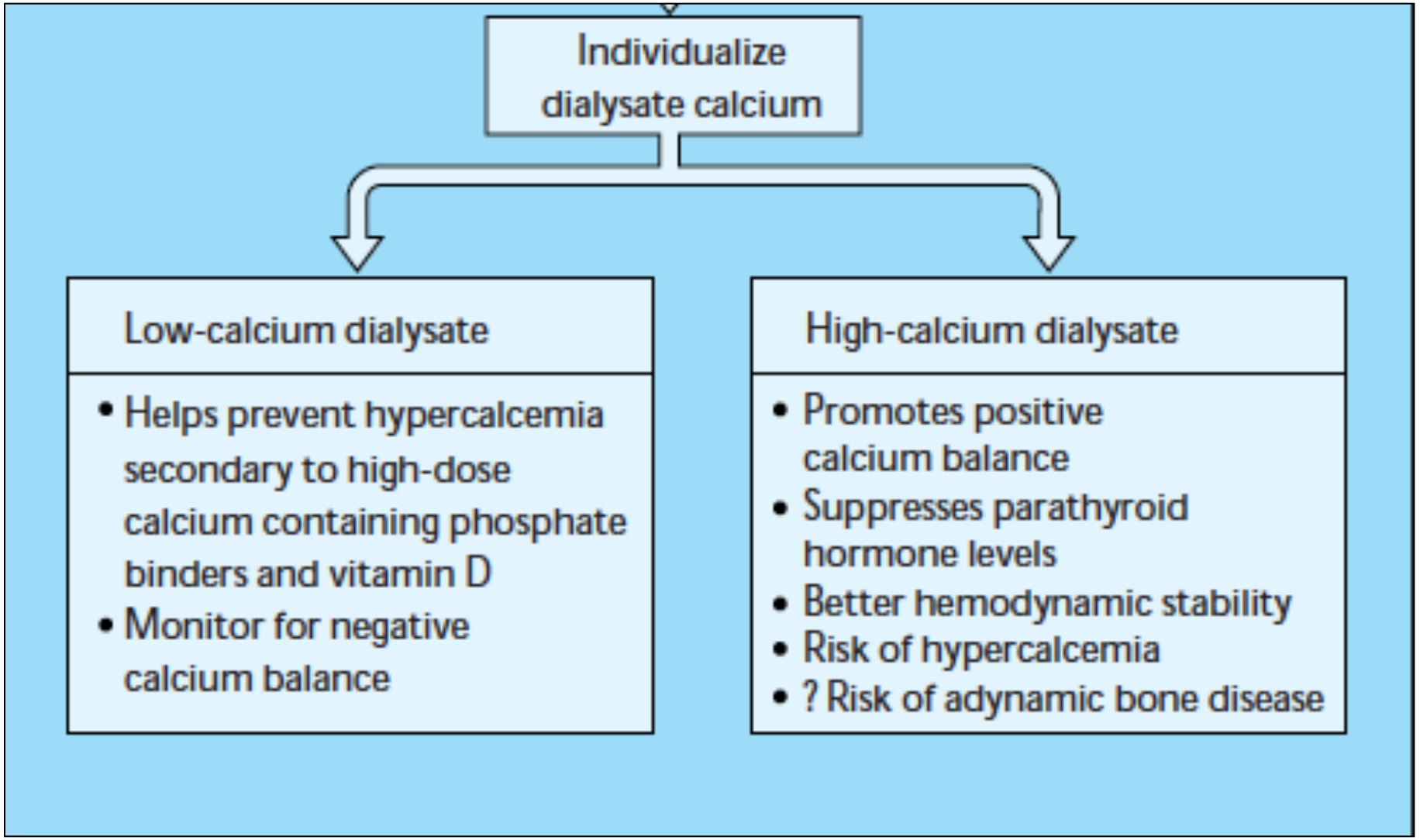

Apex Database

# Using low Calcium dialysate to improve BP




Apex Database


Individualize dialysate calcium
Low-calcium dialysate
• Helps prevent hypercalcemia secondary to high-dose calcium containing phosphate binders and vitamin D
• Monitor for negative calcium balance
High-calcium dialysate
• Promotes positive calcium balance
• Suppresses parathyroid hormone levels
• Better hemodynamic stability
• Risk of hypercalcemia
• ? Risk of adynamic bone disease

# What do we want?

- Avoid hypocalcemia and hypercalcemia
- Control Phosphatemia because it is the silent killer (vascular calcifications)
  - Ideally with dialysis but frequently limited
  - Use of non-Ca Pi binders: risk of Ca++ negative balance
  - Use of Ca-Pi binders: risk of hypercalcemia
- Control PTH: not too low and not to high

## ADVANTAGES AND DISADVANTAGES OF INDIVIDUALIZING VARIOUS COMPONENTS OF HEMODIALYSATE

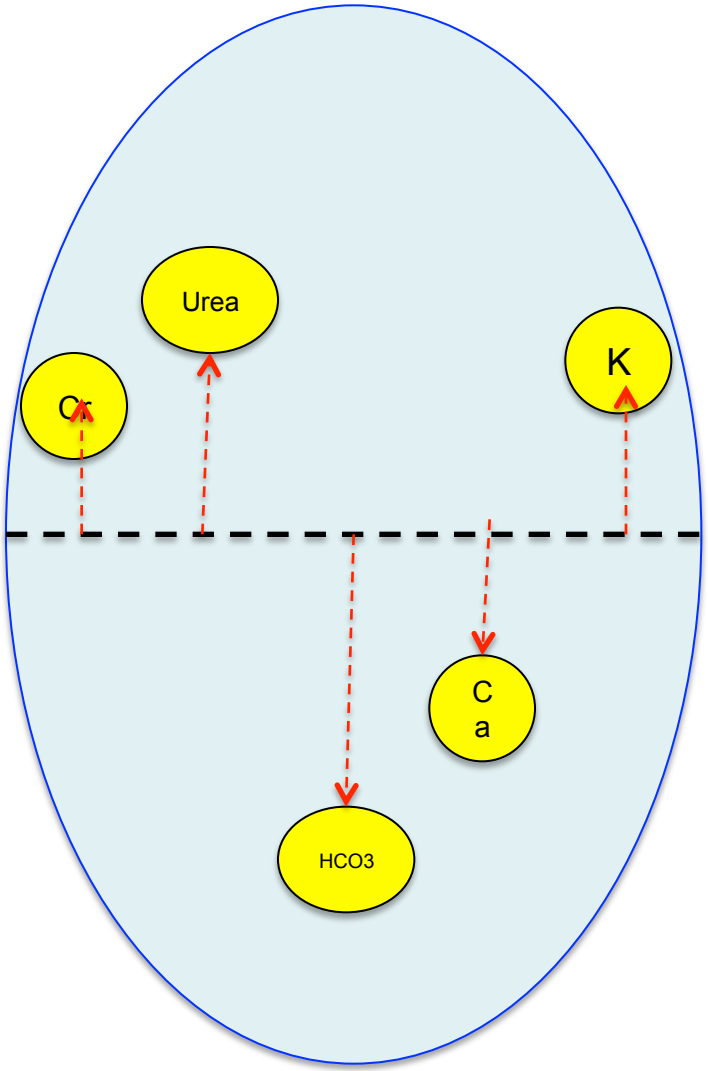
| Dialysate component and adjustment | Advantages | Disadvantages |
|---|---|---|
| Sodium: | | |
| Increased | More hemodynamic stability, less cramping | Dipsogenic effect, increased interdialytic weight gain, ? chronic hypertension |
| Decreased (rarely used) | Less interdialytic weight gain | Intradialytic hypotension and cramping more common |
| Calcium: | | |
| Increased | Suppression of PTH, promotes hemodynamic stability in HD | Hypercalcemia with vitamin D and high-dose calcium-containing phosphate binders, ? contribution to adynamic bone disease in PD |
| Decreased | Permits greater use of vitamin D and calcium containing phosphate binders | Potential for negative calcium balance, stimulation of PTH, slight decrease in hemodynamic stability |
| Potassium: | | |
| Increased | Less arrhythmias in setting of digoxin or coronary heart disease ? improved hemodynamic stability | Limited by hyperkalemia |
| Decreased | Permits greater dietary intake of potassium with less hyperkalemia ? improvement in myocardial contractility | Increased arrhythmias, may exacerbate autonomic insufficiency |

## ADVANTAGES AND DISADVANTAGES OF INDIVIDUALIZING VARIOUS COMPONENTS OF HEMODIALYSATE

| Dialysate component and adjustment | Advantages | Disadvantages |
|---|---|---|
| Bicarbonate: | | |
| Increased | Corrects chronic acidosis thereby benefits nutrition and bone metabolism | Post-dialysis metabolic alkalosis |
| Decreased | Less metabolic alkalosis | Potential for chronic acidosis |
| Magnesium: | | |
| Increased | ? Less arrhythmias, ? hemodynamic benefit | Potential for hypermagnesemia |
| Decreased | Permits greater use of magnesium containing phosphate binders which in turn permits reduced dose of calcium binders and results in less hypercalcemia | Symptomatic hypomagnesemia |

# The Dialysis Professional's job responsibility

In kidney failure




In normal people