# Fluid & Electrolyte Emergencies

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## Fluids

<table>
<thead>
<tr>
<th>Type</th>
<th>Glucose (Gm/L)</th>
<th>Osmolality (mOsm/L)</th>
<th>Na⁺</th>
<th>K⁺</th>
<th>Cl⁻</th>
<th>Ca²⁺</th>
<th>pH</th>
<th>Salt of 1000 mL</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSW</td>
<td>50</td>
<td>292</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>7.4</td>
<td>Free water</td>
<td></td>
</tr>
<tr>
<td>0.45% NaCl</td>
<td>0</td>
<td>244</td>
<td>77</td>
<td>0</td>
<td>0</td>
<td>4.5</td>
<td>0.5</td>
<td>1080 mL/Vol</td>
<td>Volume &amp; free water</td>
</tr>
<tr>
<td>0.9% NS</td>
<td>0</td>
<td>308</td>
<td>154</td>
<td>0</td>
<td>0</td>
<td>1.5</td>
<td>2100</td>
<td>IV/Infusion</td>
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</tr>
<tr>
<td>3% NS</td>
<td>0</td>
<td>2625</td>
<td>113</td>
<td>0</td>
<td>0</td>
<td>7.4</td>
<td>NA</td>
<td>Hyponatremia</td>
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<tr>
<td>DSW + 3% NaHCO₃</td>
<td>50</td>
<td>960</td>
<td>120</td>
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<td>0</td>
<td>8.0</td>
<td>2100</td>
<td>Acetazolamide</td>
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<tr>
<td>LR</td>
<td>0</td>
<td>132</td>
<td>132</td>
<td>0</td>
<td>0</td>
<td>7.4</td>
<td>1823</td>
<td>Volume</td>
<td></td>
</tr>
</tbody>
</table>

- **Others**: D10, D5NS, D5LR  
- **Price**: NS $2.10/bag, LR $2.60/bag

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## Sodium

- **Changes in volume indicate salt changes**  
  - Edematous states or hypovolemic states (Na normal)
- **Changes in sodium indicate free water changes**  
  - Dehydration, over hydration (TBW may be normal)

## Osmolality

- **Total solute concentration**
- **Tonicity**: The effect from limiting movement of certain osmole by cell membrane
  - Effective osmole: Na, K, Glucose, alcohols, mannitol
- **Hyponatremia** = hypotonicity
- **Hypernatremia** = hypertonicity

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## Hypernatremia

- **Symptoms**: CNS changes, cerebral contraction leads to easy bleeding
- **Three categories**
  - Hypernatriemic: CAH, Cushings, Conn’s
  - Euvolemic: Diuretics, vomiting
  - Hypovolemic: Free water loss (loop diuretics), osmotic diuresis (glucose, correct Na)

## Treatment (free water)

- Correct with 1/2 NS or 3% by IV
- Use NS to correct any cardiovascular instability
- May dose greater than 4 L/day
- Rapid correction leads to cerebral edema/coma/death
- Accumulation of intracellular osmole
- Has a 50% mortality rate
- Maximum correction 0.5-1 mEq/L/hour
- If possible, corrected in first 24 hours
- Follow serum sodium regularly, q4 hours

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## Fluid & Electrolyte Emergencies

- **TBW** = 0.6 x wt (kg) = (42L)
- **ICFV** = 2/3 TBW (28)  
  - ECFV = 1/3 TBW (14)
  - Interstitial = 3/4 ECFV (10.5)  
  - Intravascular = 1/4 ECFV (3.5)
- **Sodium**: 140 mEq/L
- **1L D5: 666 ml**
- **Isotonic IV Fluids**: 250 ml NS: 0, 750 ml 250 ml D5W
- **Acidosis**: 2100 ml NaHCO₃
- **D5W & 3% NaCl**
- **Lactate**: 4400 ml
- **Hyponatremia**: 0 ml 3% NS
- **Volume**: 33 L RLR
- **Hypernatremia**: 0 ml 0.9% NS
- **Free Water**: 0 ml D5W
- **Price**: NS $2.10/bag, LR $2.60/bag

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Hypernatremia: Calculating free H2O deficit

► Classic equation
  - Total body deficit
    - H2O = 0.6 X (wt) X \(\frac{Na}{140} - 1\)
  - Intravascular deficit
    - 70 kg X 0.6 = 42 L TBW
      - 42 L X \(\frac{1}{3}\) = 14 L ECFV
      - 14 L X 0.6 = 8.4 L IVF
    - H2O = 14 L X 0.6 = 8.4 L
    - 14% higher Na
      - H2O = 0.6 X (wt) X \(\frac{140}{140} - 1\)
      - H2O = 0.6 X (wt) X 0.14

Intravascular deficit:

70 kg X 0.6 = 42 L TBW

42 L X \(\frac{1}{3}\) = 14 L ECFV

14 L X 0.6 = 8.4 L IVF

H2O = 14 L X 0.6 = 8.4 L

14% higher Na

14% higher Na

H2O = 0.6 X 70 X 0.14

H2O = 5.88 L

For this patient 5.88 L needed to correct entire deficit (20 mEq).

DI is lack of ADH

- Lack of ADH means water loss = dilute urine
- Patients presenting with hypernatremia and low urine osmolality means there is a lack of ADH, or Diabetes Insipidus

Dehydration test - results

- Complete DI: osmolality of urine < plasma
  - Serum vasopressin low with central, high with nephrogenic
  - DDAVP corrects central
- Partial DI: osmolality of urine > plasma but not maximal
  - Serum vasopressin low normal with central, high with nephrogenic
  - DDAVP helps central more than nephrogenic

Diabetes Insipidus

- Lab: hypernatremia, low urine Na & osmol <150
- Hypothalamic (pituitary/production)
  - Partial or Complete
  - Causes: trauma, mets, radiation, CNS inf/granuloma
- Nephrogenic (defect in receptor)
  - Partial or Complete
  - Causes: hypercalcemia, hypokalemia, Li, demeclocycline, amphoBB

Diabetes Insipidus

- Dehydration test - no water
  - For clinical suspicion, not acute hypernatremia
  - Follow urine osmol hourly, plasma osmol every 4 hours, check vasopressin level at maximal dehydration
  - Continue until weight down 3%, plasma osmol >295, urine osmolality plateaus <5% change

Treatment

- Vasopressin
  - 5-10 units IM/SC bid-qid
- Desmopressin (DDAVP) nasal
  - 10 mcg/spray
  - One spray qd-tid
  - 2 mcg SC/IV bid

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Hypernatremia Summary

- Requires urgent therapy to prevent mortality
- Identify cause
  - Treat hypovolemia
  - Remember to think about Diabetes Insipidus (DDAVP)
- Replace free water losses
  - Make calculations
    - H2O = 0.6 X (wt) X \(\frac{Na}{140} - 1\)
  - Slow continuous correction
    - 0.5-1 mEq/L/hour
  - Follow changes
    - BMP q 4 hours
Hyponatremia

- Low sodium indicates excess H2O
  - Acute hyponatremia causes brain edema
  - Level of Na causing emergency dependent on acute or chronic
  - Becomes an emergency when patient unstable
    - Seizures, coma
- Remember to correct for glucose
  - Change in Na = 1.6 for every 100 of glucose

Euvolemic Hypotonic Hyponatremia

- Rule out adrenal insufficiency and hypothyroidism
- Psychogenic polydipsia
  - Urine >500, corrects with limiting intake
  - Minimum Uosm is 50 (takes 12-18 L to lower Na)
- Thiazides
  - Impair solute reabsorption (Na Cl)
  - Loops impair solute and water
- Beer Potomania or Tea & Toast Diet
  - Mostly carbs metabolized to CO2, minimal solute (Na) intake

Hyponatremia Treatment

- Hyponatremic emergency (seizures/MS change)
  - 5 mEq/L increase should be enough to reduce symptoms
  - 100 m/lhr 3% NS is safe until calculations made
    - One hour increases Na on average 1-2 mEq/L
    - Slow infusion when symptoms improve
  - Acute correction causes osmotic demyelinating syndrome
    - May develop days after correction
    - Can be fatal, or permanent neurological deficit
  - Sodium change should be 0.5-1 mEq/hr
    - D= calculation: TBW (0.6Xwt) X (NaH - NaL)
    - Check BMP regularly, q4 hour

Hyponatremia Classification

- Hypertonic: a substance pulls more water into ECF
  - Mannitol, hyperglycemia
- Isotonic: pseudo-hyponatremia is a measurement artifact
  - Hyperproteinemia (1 mEq for 0.25 gm/dl)
  - Hypertriglyceridemia (1 mEq per 500 mg/dl)
- Hypotonic: (most common)
  - Hypovolemic: CHF, cirrhotic, CRF, nephrotic syndrome
  - Euvolemic: SIADH, adrenal insufficiency, nephryptic polydipsia
  - Thiazides, "tea & toast" diet, beer potomania
  - Hypovolemic: GI (N/V/D/NG), GU (remote diuresis), 3rd spacing (pancreatitis, burns).
- Measured osmolality needed to separate

Euvolemic Hypotonic Hyponatremia SIADH

- Diagnosis
  - Hyponatremia with Uosm>Sosm (280), high urine Na
  - Low uric acid, PO4, BUN
  - Causes
    - Excessive or abnormal ADH - CSF, brain injury, CA (SCLC), post-op, drugs, TCAs, SSRIs, narcotics, etc.
  - Treatment
    - Water restriction: estimate by osmoles consumed/Uosm
      - Normal solute intake 600-900 osmoles/day
      - If intake 900 osmoles & minimum Uosm 50 = 900/50 = 18 L
      - If intake 600 osmoles & minimum Uosm 300 = 600/300 = 2 L
      - If intake 100 osmoles & minimum Uosm 100 = 100/100 = 1 liters

Hyponatremia

Example

- 80 yo F with tea and toast diet/thiazides, mild symptoms, appears euvolemic. Sodium 108, measured osm 236, urine osm 200, urine Na 10 mEq/L

- Na deficit = TBW (0.6Xwt) X (NaH - NaL)
  - 42 X (120-108) = 504 meq Na

- Salt available
  - 3% NS = 513 mEq (need 1 liter over 12-24 hours)
  - NS = 154 mEq (need 3.3 lit over 12-24 hours)
**Hyponatremia Summary**

► For emergency
  - Try to change the sodium by 5 mEq

► For urgency
  - Rule out SIADH
    - Be able to estimate fluid restriction
    - IVF will minimally change Na, may lower
  - For others calculate sodium needs
    - Na deficit = TBW (0.6Xwt) X (NaII – NaF)
    - Change sodium 0.5–1 mEq/L/hour
    - Follow lab close, q4 hour

**Hyperkalemia**

► Signs and symptoms
  - Weakness, paralysis, respiratory failure
  - EKG
    - First (K+ 6): flat P wave, long PR, peaked T, esp precordial
    - Second (K+ 7–8): wide QRS, bradycardia with junctional rhythm
    - Finale (K+ 9–10): sine wave

Degree of symptoms depends on chronicity and age – not always an emergency. Check EKG

► Impaired secretion or intake?
  - TTKG = U/S K ÷ U/S Osmolality
  - Renal defect TTKG <6, not appropriately excreting
    - Causes:
      - Addison’s (hypoadosteronism), heparin
      - Hyporeninemic hypoadosteronism (DM)
      - Renal failure (ANH or CRF)
    - Drugs: NSAIDs, ACE, ARB, B-blocker, cyclosporin, potassium sparing diuretics, TMP
  - Non-renal TTKG >10, good excretion
    - Causes:
      - Diet: TPN, salt substitutes
      - Tissue breakdown: hemolysis, transfusion (5mEq/RBC), burns, surgery

**Potassium**

- Pseudohyperkalemia
  - plt > 1M, WBC > 200, hemolysis, familial pseudohyperkalemia (leaky RBC)
- Redistribution
  - 56 mEq in ECFV normally, total body with 4200 mEq
    - Metabolic Acidosis (0.6 increase for every 0.1 pH)
    - Respiratory Acidosis (0.3 increase for every 0.1 pH)
- Digoxin toxicity (Na–K ATPase pump)
- Beta-blockers (0.2 mEq increase)
- Succinylcholine (0.5 mEq)
- Autosomal dominant hyperkalemic periodic paralysis
  - Usually high K+ (6–8), induced by cold, high potassium diet

**Hyperkalemia**

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**Hyperkalemia**

► Treatment
  - EKG, if no change than urgency not emergency
  - Calcium gluconate 1 amp (1gm IV over 5 min)
    - Antagonizes cardiac effects, immediate on EKG
    - Lasts one hour, no change in K+
  - One amp DS0 with 10 units insulin
    - Translocates K+ into cells after 30–60 minutes
    - Lasts 1–2 hours
  - Beta 2 agonist, albuterol neb
    - Translocates K+ into cells, additive to insulin & glucose
    - 10–20 mg albuterol (5mg/5ml) nebulized over 10 minutes
    - Onset 30 minutes
Hyperkalemia

- Treatment
  - HCO3
    - Most helpful when acidosis is present.
    - One amp = 50 mEq NaHCO3
  - Sodium polystyrene sulfonate – Kayexalate
    - 30 gm removes approx 30 mEq K+ (0.3 mEq/L)
    - Oral with sorbitol (2 hours) or rectally (1 hour)
    - Intestinal necrosis reported
    - Do not give without follow up lab
  - Hemodialysis
    - Definitive
    - Takes 1-2 hours to begin, need line, nursing, etc

Hypokalemia

- Clinical findings
  - Weakness, paralysis, constipation, ileus, respiratory dysfunction, rhabdomyolysis, nephrogenic DI, supraventricular arrhythmias
  - EKG: flattened T waves, prominent U waves

- Treatment
  - Potassium is irritating to veins
  - PIV limit concentrations to 40 mEq/L, rate 10 mEq/hr
    - Potassium %K mEq/g K
    - For alkalosis
      - Potassium chloride 52 13.4
    - For acidosis
      - Potassium acetate 40 10.2
      - Potassium bicarbonate 39 10
      - Potassium citrate 38 9.8
      - Potassium gluconate 17 4.3

Hypokalemia

- Causes
  - Spurious
    - WBC>100 if blood sits at room temp
  - Redistribution
    - Insulin, alkalemia (0.3 mEq/L for 0.1 pH), beta agonists (Na/K ATPase), theophylline, B12
    - Familial hypokalemic periodic paralysis
      - AD, recurrent flaccid paralysis in childhood
    - Hypokalemic periodic paralysis with thyrotoxicosis
      - Complication of thyroid disease with paralysis, esp in Asian

- Extra renal losses
  - Urine K+ < 20, TTKG <2
  - Diarrhea, villous adenoma, anorexia

- Renal losses: U K+ > 20, TTKG > 4
  - RTA I-II, diuretics, low Mg, aminoglycosides, cisplatin, post ATN diuresis, ketoacidosis
  - Aldosterone excess (HTN, saline, vomiting, volume depletion)

Calcium

- Vitamin D: increases both Ca and PO4
  - Active on gut, kidneys, parathyroid gland
- PTH: increases Ca, decreases PO4
  - Active on kidneys, bone
- Calcitonin: decreases Ca
  - Active on bone, kidney
Calcium Regulation

Calcium regulation

TAL of the loop of Henle
Distal Convoluted Tubule

Hypercalcemia

► Signs and symptoms
- Anorexia, N/V, acute pancreatitis, stupor, coma, short QT interval, increased toxicity of cardiac glycosides, polyuria, polydipsia, nephrolithiasis, renal failure, calciphylaxis.

Adapted from Cogan, Fluid and Electrolytes, 1991

Calcium content of foods

<table>
<thead>
<tr>
<th>High (≥250 mg)</th>
<th>Medium (150 - 250 mg)</th>
<th>Low (&lt;150 mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk Products</td>
<td>Cottage cheese (6 oz)</td>
<td>Bread (1 slice)</td>
</tr>
<tr>
<td>Milk (whole or lowfat) (8 oz)</td>
<td>Tofu (4 oz)</td>
<td>Cereal (8 oz)</td>
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<tr>
<td>Yogurt (8 oz)</td>
<td>Green vegetables (4 oz)</td>
<td>Meat (3 oz)</td>
</tr>
<tr>
<td>Ice cream (8 oz)</td>
<td>Collard greens</td>
<td>Chicken, Turkey, Duck, Lamb, Pork, Bacon</td>
</tr>
<tr>
<td>Cheese (2 oz)</td>
<td>Turnip greens</td>
<td>Fish: Shellfish, Clams, Oysters</td>
</tr>
<tr>
<td>Chocolate Milk (6 oz)</td>
<td>Mustard greens</td>
<td>Nuts: Peanuts, Almonds, Walnuts</td>
</tr>
<tr>
<td>Canned salmon</td>
<td>Turnip greens</td>
<td>Rice: Brown Rice, Cereals (fortified)</td>
</tr>
<tr>
<td>Canned sardines</td>
<td>Turnip greens</td>
<td>Nuts: Peanuts, Almonds, Walnuts</td>
</tr>
<tr>
<td>Fresh salmon (4 oz)</td>
<td>Turnip greens</td>
<td>Rice: Brown Rice, Cereals (fortified)</td>
</tr>
<tr>
<td>(4 oz with shell)</td>
<td>Turnip greens</td>
<td>Nuts: Peanuts, Almonds, Walnuts</td>
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</table>
Hypercalcemia

- Elevated PTH
  - Li (increases PTH), familial hypocalciuric hypercalcemia (inactivation of calcium receptor, AD), primary HPTH, tertiary hyperparathyroidism
- Normal PTH, Elevated PTHrp
  - Cancer (squamous lung cancer)
- Normal PTH, normal PTHrp, Elevated Vitamin D
  - Hypervitaminosis D, Granulomatous disease (sarcoid, lymphoma, TB)
- Normal PTH, normal PTHrp, normal vitamin D
  - Thiazides, vitamin A toxicity, hyperthyroidism, immobilization, Paget’s disease, MM/breast/lung/lymphoma

> Mild Ca <12
- Hydration orally, correct disorder

> Moderate or Severe Ca >12
- IVF NS for UOP 100cc/hour
- Loop diuretic if needed for UOP
- Steroids for granulomatous disease/Vit D
- Calcium: mild effect, short acting, tachyphylaxis
- Bisphosphonates
  - Pamidronate: IV, 30/60/90 mg, dosed every 4 wks, long lasting
  - Zoledronic acid (Zometa): IV, 4 mg, dose every week, short infusion
  - Etidronate: PO daily or IV X 3d then q wk
  - Alendronate, risedronate

Hypocalcemia

- Signs and symptoms
  - Tetany, seizures, coma, long QT, fractures, brittle nails, parasthesias
  - Calcium changes 0.8 for each 1 of albumin
  - Measure Ionized calcium for accuracy

- Normal/elevated Vit D & PTH - calcium loss
  - Loop diuretics, tumor lysis syndrome, rhabdomyolysis, pancreatitis, hungry bone syndrome, citrate from blood products
- Vitamin D deficiency
  - Low sun, low intake, low production (phenytoin, barbiturates for liver, chronic kidney disease)
- PTH deficiency: Hypoparathyroidism
  - Congenital (DiGeorge Syndrome), acquired (thyroidectomy, irradiation, hungry bone syndrome/Post op HPTH), functional (low Mg)
- Pseudohypoparathyroidism
  - Low calcium, high phosphorus, high PTH
  - PTH receptor resistance

- Loop diuretics, tumor lysis syndrome, rhabdomyolysis, pancreatitis, hungry bone syndrome, citrate from blood products
- Low sun, low intake, low production (phenytoin, barbiturates for liver, chronic kidney disease)
- Congenital (DiGeorge Syndrome), acquired (thyroidectomy, irradiation, hungry bone syndrome/Post op HPTH), functional (low Mg)
- Low calcium, high phosphorus, high PTH
- PTH receptor resistance
**Hypocalcemia**

- **Replacement**
  - Calcium 1500 mg/d PO
    - On empty stomach
  - 1-2 gm calcium gluconate IV
  - Vitamin D
    - 400 IU qd PO
- **Conservation**
  - Thiazide or potassium sparing diuretics

**Phosphorus**

**Hyperphosphotemia**

- **Signs & Symptoms**
  - Acute: no significant changes
  - Chronically: Uremic calcific arteriolopathy = cardiac calcification
- **Increased intake**
  - Excess vitamin D, folic acid
- **Decreased excretion**
  - Hypoparathyroidism, rhabdo, tumor lysis, burns, trauma
  - Kidney failure
  - Primary hyperparathyroidism, PTHr, tumor associated osteomalacia, Fanconi syndrome, foscarnet, ifosfamide, cisplatin, aminoglycosides, diuresis acetazolamide > thiazides

**Hypophosphotemia**

- May lead to weakness (respiratory, cardiac or ileus) or rhabdomyolysis, potential CNS changes
- PO4 < 1 requires IV treatment
  - Other by PO
- Insufficient intake
  - Chronic alcoholism, vitamin D deficiency, stereo therapy, Cushing’s, malabsorption, diarrhea
- Increased loss
  - Primary hyperparathyroidism, PTHr, tumor associated osteomalacia, Fanconi syndrome, foscarnet, ifosfamide, cisplatin, aminoglycosides, diuresis acetazolamide > thiazides

**Phosphorus content of foods**

<table>
<thead>
<tr>
<th>Phosphorus mg</th>
<th>Sodium mEq</th>
<th>Potassium Meq</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phosphate PO</td>
<td>11</td>
<td>1.1</td>
</tr>
<tr>
<td>Neutra-Phos</td>
<td>7.1</td>
<td>7.1</td>
</tr>
<tr>
<td>Neutra-Phos K</td>
<td>0</td>
<td>14.2</td>
</tr>
<tr>
<td>Potassium</td>
<td>3</td>
<td>4.4</td>
</tr>
<tr>
<td>Sodium phosphate</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

3 mmol/ml of phosphate corresponds to 93 mg of phosphorus
Magnesium

► Hypermagnesemia
- N/V, lethargy, hypotension, bradycardia, loss of DTR.
- Mg > 9 causes paralysis, heart block.
- Requires administration

► Hypomagnesemia
- Tetany, weakness, seizures, long QT, U waves, arrhythmias, potassium wasting, impaired PTH, osteomalacia
- GI: nutrition, malabsorption, bowel resection, etc
- Renal: osmotic diuresis, loop diuretics, aminoglycosides, pentamidine, cephalosporin, alcohol
- 24 hour collection Mg > 24 mg indicates renal wasting

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**Magnesium Replacement Therapy**

<table>
<thead>
<tr>
<th>Magnesium salt</th>
<th>Desired formula</th>
<th>Replacement ratio</th>
<th>Samples?</th>
<th>Mg content</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intravenous</td>
<td>MgSO4.H2O</td>
<td>14</td>
<td>Yes</td>
<td>25 mg/ml</td>
<td>-</td>
</tr>
<tr>
<td>Ceclor</td>
<td>Mg2+/HCO3-</td>
<td>1:2</td>
<td>100%</td>
<td>24 mg/g</td>
<td>-</td>
</tr>
<tr>
<td>Laxiron</td>
<td>MgSO4.H2O</td>
<td>1:2</td>
<td>100%</td>
<td>24 mg/g</td>
<td>-</td>
</tr>
<tr>
<td>Laxium</td>
<td>MgSO4.H2O</td>
<td>1:2</td>
<td>100%</td>
<td>24 mg/g</td>
<td>-</td>
</tr>
<tr>
<td>Thalasse</td>
<td>Mg2+/HCO3-</td>
<td>1:2</td>
<td>100%</td>
<td>24 mg/g</td>
<td>-</td>
</tr>
<tr>
<td>Eclax</td>
<td>Mg2+/HCO3-</td>
<td>1:2</td>
<td>100%</td>
<td>24 mg/g</td>
<td>-</td>
</tr>
<tr>
<td>Stepone</td>
<td>Mg2+/HCO3-</td>
<td>1:2</td>
<td>100%</td>
<td>24 mg/g</td>
<td>-</td>
</tr>
<tr>
<td>Tanax</td>
<td>Mg2+/HCO3-</td>
<td>1:2</td>
<td>100%</td>
<td>24 mg/g</td>
<td>-</td>
</tr>
<tr>
<td>Calcost</td>
<td>Mg2+/HCO3-</td>
<td>1:2</td>
<td>100%</td>
<td>24 mg/g</td>
<td>-</td>
</tr>
<tr>
<td>C25</td>
<td>Mg2+/HCO3-</td>
<td>1:2</td>
<td>100%</td>
<td>24 mg/g</td>
<td>-</td>
</tr>
<tr>
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<td>100%</td>
<td>24 mg/g</td>
<td>-</td>
</tr>
<tr>
<td>Meta Magnesia</td>
<td>Mg2+/HCO3-</td>
<td>1:2</td>
<td>100%</td>
<td>24 mg/g</td>
<td>-</td>
</tr>
</tbody>
</table>

**Thanks**

► Hypertension, Dialysis and Clinical Nephrology at HDCN.com
- Links and presentations on all kidney diseases

► Online clinical calculators
- ABG, fluids, FENa, TTKG, BMI, GFR, steroid conversion
- MedCalc.com

► Palm application: NephroToGo
- OS/PC app with concise review of kidney disease
- nephrotogo.com