Essentials of Pharmacology for Complementary Health Practitioners

Note: Cancer Drugs are Covered in the Adjunctive Nutritional Management of Cancer Subject on this Platform

James Meschino DC, MS, ROHP

Why Study Pharmacology:

1. Many patients/clients you see are taking medications.
2. You should know the effect each drug is having on the patient's physiology before making dietary, exercise or supplementation recommendations (e.g. beta-blocker and aerobic exercise).
3. You should be on the look out for drug side effects masquerading as primary health conditions (e.g. tinnitus from aspirin, back pain from statins) that physician may have missed.
4. There are 8 important drug-supplement considerations that must be factored in to the dietary, exercise and supplementation recommendations you recommend:

The 8 Key Drug-Supplement Considerations:

1. Some drugs can do things that supplements can not (e.g. muscle relaxants).
2. Some supplements can do things that drugs can not (e.g. rebuild cartilage, increase synthesis of acetylcholine in brain).
3. Some supplements work **synergistically** with a drug, reducing drug dosage where the drug is known to produce adverse side effects (e.g. acetaminophen damage to liver).
4. Some supplements can potentiate the effects of drugs producing serious side effects (e.g. bleeding disorders, serotonin syndrome etc).

5. Some supplements reduce the efficacy of a drug by stimulating its detoxification (e.g. St John's Wort and Birth Control Pill).

6. Some supplements are contra-indicated in certain health conditions (e.g. Wilson's disease and copper).

7. Certain supplements require specific monitoring or physician approval in specific cases (e.g. organ transplants and immuno-suppressive drugs, liver or kidney disease, cancer).

8. In pregnancy and breast feeding certain supplements must be removed and replaced by others to protect the small fetal body.

Brief History Of Drugs

- Pharmaceutical Industry did not begin until 1941, when Chain and Florey (during WWII) discovered that penicillin could be taken orally to fight bacterial infections.
- In 1928 Alexander Fleming discovered that penicillin spores (from the penicllin mold) that had become air-borne from the lab below were able to prevent the growth of the staphylococcus bacteria he was studying in the lab above (an accidental innoculation).
- Until 1941, penicillin was only used to treat topical bacterial infections, until Chain and Florey discovered that it could be used internally. This was the birth of the pharmaceutical industry.
- However, The use of Digitalis purpurea extract containing cardiac glycosides for the treatment of heart conditions dates back to 1785.

- In a very short period of time Pharmaceutical companies have convinced medical doctors, and most of the modern world, to ignore all previously used natural remedies and focus only on their synthetic drugs.

- Prior to 1941, only natural medicines were available to treat patients.(e.g. colloidal silver to treat TB and infections).

The Pendulum Has Swung So Far To One Side That Natural Remedies Have Been Dismissed:

However, in recent years the use of, and search for, drugs and dietary supplements derived from plants have accelerated.

Pharmacologists, microbiologists, botanists, and natural-products chemists are combing the Earth for phytochemicals and leads that could be developed for treatment of various diseases.

Integrative Cancer Therapies Program taught by the American Academy For The Advancement Of Medicine empahasizes many supplements

Impact Of Adverse Drug Effects:

- The Institute of Medicine found that as many as 98,000 hospitalized Americans die every year and 1 million more are injured as a result of preventable medical errors that cost the nation as estimated $29 billion.

- Adverse drug reactions were the **4th leading cause of death** in the United States in the year 2000 - more common than breast cancer, AIDS or traffic accidents - with costs of more than $170 billion.

- In addition to these costs, The Centers for Medicare and Medicaid stated in a recent report that the nation spent **$140.6 billion in the year 2000 on prescription drugs**.

Cardiovascular Section

Part 1. Anti-hypertensive Drugs:

1. Diuretics
2. Beta-blockers
3. Calcium-Channel blockers
4. ACE-Inhibitors
5. ARBs
6. Renin-blockers

Diuretic Drugs

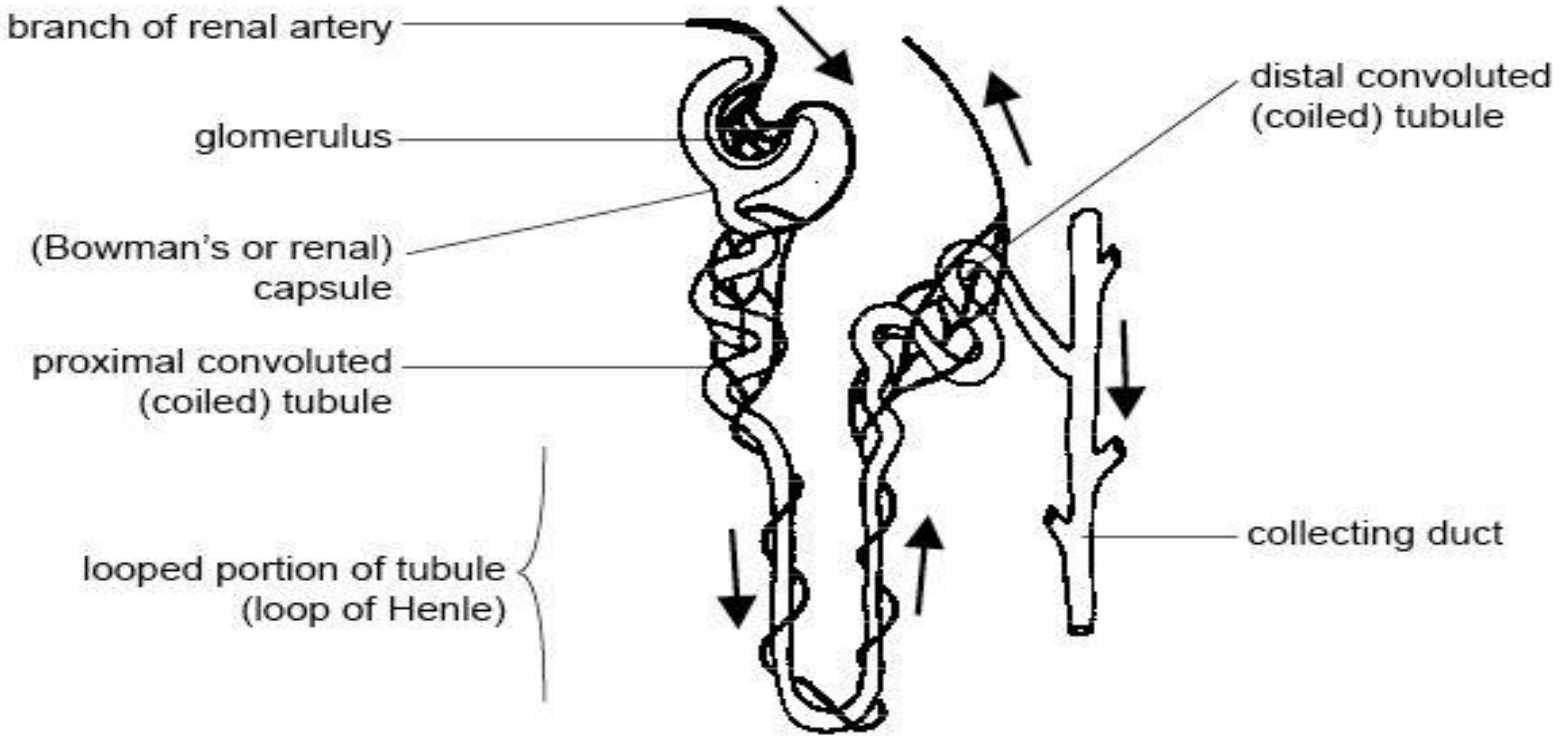
A. **Diuretics**: elevate rate of urination and water loss

This reduces blood volume and thus reduces systolic and diastolic pressure – less total pressure in system

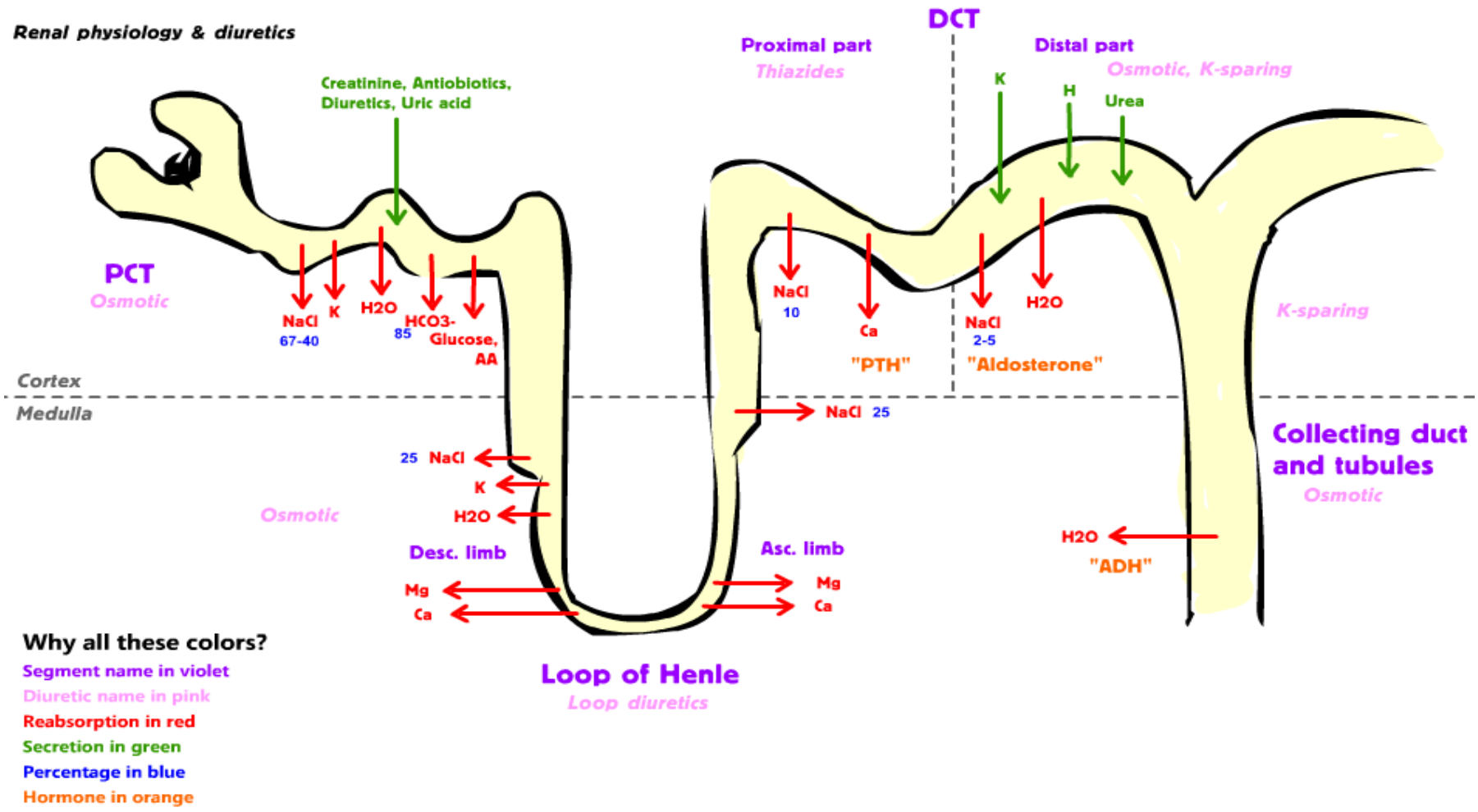
Several categories of diuretics:

Distal Tubule Diuretics

- **Kidneys** – 21% of cardiac output filtered by kidneys
- **About 1200 ml/min** is rate of blood flow through both kidney (70 kg man)
- **99% of filtrate** reabsorbed (1% becomes urine)



Renal Physiology and Diuretics: Note Aldosterone Effect At DCT and ADH In CD



1. High ceiling diuretics cause substantial diuresis - up to 25% of the filtered load of NaCl and water end up in urine.

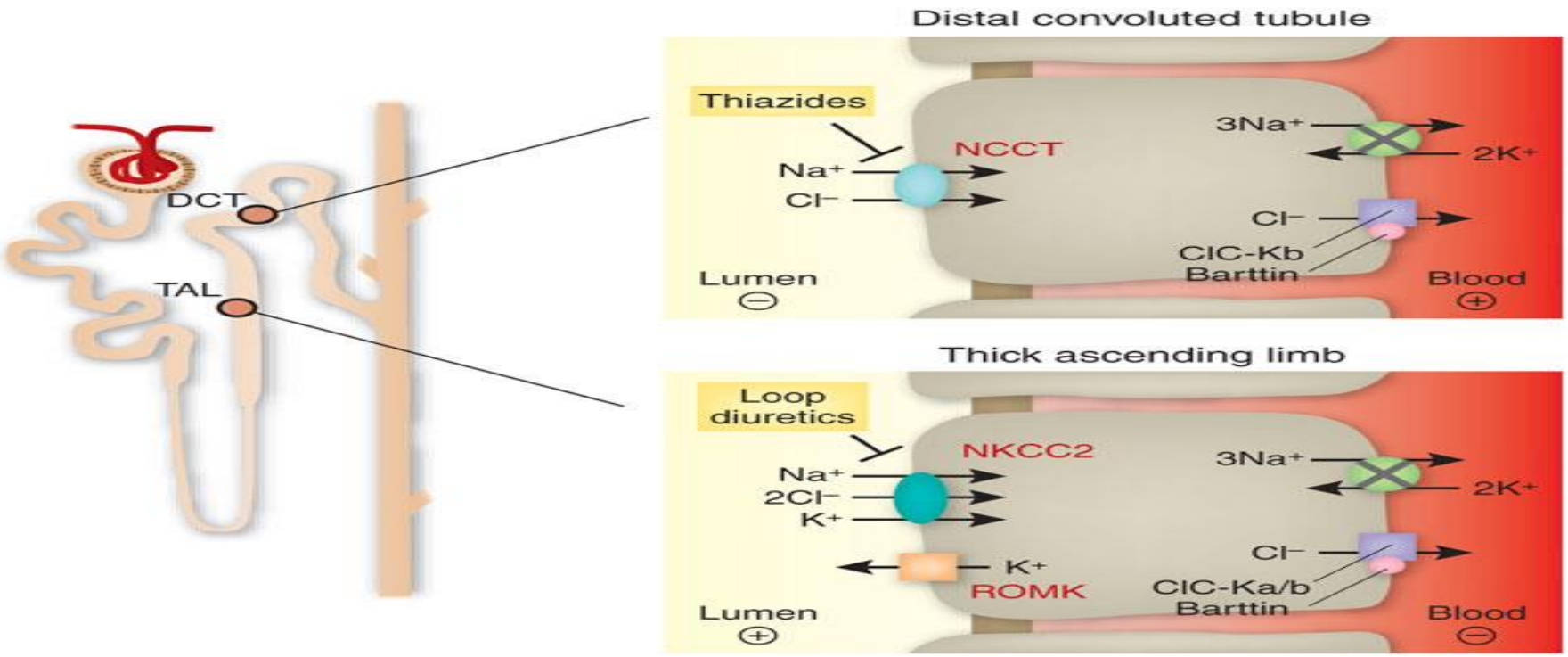
- This is huge - normal renal sodium reabsorption leaves only ~0.4% of filtered sodium in the urine.

- **Loop diuretics** are usually “high ceiling diuretics”, which inhibit sodium resorption at the ascending loop

- **Low Ceiling Diuretic (e.g. thiazides)** - rapidly flattening dose effect curve (in contrast to "high ceiling")

Target Sites For Diuretics

- **High Ceiling Loop diuretics** inhibit **25%** NaCl resorption in **TAL**
- The **thiazide drugs** inhibit **5–10%** of the NaCl reabsorption in **DCT**
- Excretion of NaCl drags water out of body, lowering blood volume and decreasing blood pressure



Preventing Hypokalemia from Diuretics

- Because loop and thiazide diuretics increase sodium delivery to the distal segment of the distal tubule, this increases potassium loss (potentially causing *hypokalemia*) because the increase in distal tubular sodium concentration stimulates the aldosterone-sensitive sodium pump to increase sodium reabsorption in exchange for potassium and hydrogen ion, which are lost to the urine.

- The increased hydrogen ion loss can lead to *metabolic alkalosis*. Part of the loss of potassium and hydrogen ion by loop and thiazide diuretics results from activation of the renin-angiotensin-aldosterone system that occurs because of reduced blood volume and arterial pressure.

- Increased aldosterone stimulates sodium reabsorption and increases potassium and hydrogen ion excretion into the urine

- **Hypokalemia** is associated with increased risk of arrhythmia in patients with cardiovascular disease, as well as increased all-**cause** mortality, cardiovascular mortality and heart failure mortality by up to 10-fold.

- Derangements of potassium regulation often lead to neuromuscular, gastrointestinal and cardiac rhythm abnormalities. The normal level of plasma potassium is 3.8 – 5.1 mmol/L.

- The deviations to both extremes (hypo- and hyperkalemia) are related to the risk of cardiac arrhythmias.

Potassium-Sparing Diuretics

- A third class of diuretic are **potassium-sparing diuretics**. Unlike loop and thiazide diuretics, some of these drugs do not act directly on sodium transport.
- Some drugs in this class antagonize the actions of aldosterone (**aldosterone receptor antagonists**) at the distal segment of the distal tubule. This causes more sodium (and water) to pass into the collecting duct and be excreted in the urine.
- They are called K^+-sparing diuretics because they do not produce hypokalemia like the loop and thiazide diuretics. The reason for this is that by inhibiting aldosterone-sensitive sodium reabsorption, less potassium and hydrogen ion are exchanged for sodium by this transporter and therefore less potassium and hydrogen are lost to the urine.
- Other potassium-sparing diuretics directly inhibit sodium channels associated with the aldosterone-sensitive sodium pump, and therefore have similar effects on potassium and hydrogen ion as the aldosterone antagonists.
- Because this class of diuretic has relatively **weak effects on overall sodium balance**, they are often used in conjunction with thiazide or loop diuretics to help prevent hypokalemia

Reference: http://www.cvpharmacology.com/diuretic/diuretics

3. Potassium-Sparing Diuretics – Inhibit secretion of potassium into urine, by inhibiting aldosterone, or by blocking sodium channels.

Aldosterone Effects:

- Promotes resorption of sodium into bloodstream to increase blood pressure with **secretion of potassium into the urine**.
- Potassium-sparing diuretics counter these effects, often used with other diuretic drugs that otherwise tend to promote excess potassium loss in urine.

(hypokalemia – muscle weakness and/or paralysis, atrial fibrillation etc)

Diuretic Drugs – prevent sodium resorption, but increase potassium loss in urine – hence risk of hypokalemia

Potassium-Sparing Drugs – decrease amount of potassium secreted into kidney tubule, to prevent excess loss of potassium that otherwise occurs with diuretics

e.g. Spironolactone is a Potassium-sparing diuretic that is an aldosterone antagonist

Clinical Applications For Diuretics:

1. * Hypertension
2. *Heart failure – flush out water & reduce strain on heart
3. Liver cirrhosis
4. Certain kidney diseases

Adverse Side Effects Of Diurtetics:

1. *Lassitude, Fatigue - Hypovolemia
2. * Muscle Cramps – sodium/potassium imbalance
3. * Gout - Hyperuricemia (sodium lost in urine at expense of uric acid)
4. * Hypercholesterolemia – mild effect on cholesterol raising
5. *Arrhythmia – Hypokalemia – leading to sudden death
6. Metabolic alkalosis – from excess loss of Na and K

Some Common Diuretic Drugs:

- Furosemide, (Lasix)
- Thiazides
- Indapamide, (Lozal)
- Mannitol, (Osmitrol)
- Chlorthalidone (Hygroton, Thalidone)