Loop Diuretics

Loop diuretics are a class of diuretics that inhibit the Na-K-2Cl symporter in the thick ascending limb of the loop of Henle. Furosemide is the generic name for one of the most commonly used loop diuretics, and is also known by the trade name, Lasix. These drugs are sulfa drugs, as they contain a sulfonamide group and can cause allergic reactions in patients with sulfa allergies. Loop diuretics often also lead to electrolyte abnormalities, such as hypokalemia and hypocalcemia. Additionally, these drugs can reduce urate excretion, leading to hyperuricemia, and subsequently gout. Ototoxicity is also a serious, but rare adverse effect of loop diuretics.



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Mechanism of Action

Thick Ascending Limb of Loop of Henle
Thick Ascending Limb from Loop Hen
Loop diuretics act on the Na-K-2Cl symporter, a type of cotransporter in the thick ascending limb of the loop of Henle. The medullary thick ascending limb is mostly impermeable to water, but the decreasing solutes in the urine leads to diluting urine (drop in urine osmolality)

Inhibits Na+-K+-2Cl- Symporter
Tied-up Salt-shaker, Banana, and Chlorine-dispenser in (2) Tutu
Loop diuretics act on the Na-K-2Cl symporter in the thick ascending limb of the loop of Henle. Here they inhibit sodium and chloride reabsorption by competing for the Cl binding site. By disrupting the Na-K-2Cl symporter, loop diuretics prevent the generation of a hypertonic renal medulla. This prevents urine from being concentrated, and leads to increased urine production, thus reducing intravascular volume.

Sulfa Drug
Sulfur-match
Furosemide (Lasix) contains a sulfonamide group, and can cause an allergic reaction in patients with sulfa-group allergies.

Drug Names

Furosemide
Fur-rose
Furosemide is the generic name for Lasix, one of the most commonly used loop diuretics. Keep in mind that this drug is classified as a sulfa drug, and should be avoided in those with sulfa allergies.

Lasix
Laser
Lasix is the brand name for furosemide and is one of the most commonly used loop diuretics. Keep in mind that this drug is classified as a sulfa drug, and should not be used in those with allergies to these medications.

Side Effects

Gout
Gout-goat
High levels of uric acid in the blood is the underlying cause of gout. This can occur for a number of reasons, including diet, medications, genetics, or underexcretion of urate from the kidneys. Diuretics reduce urate excretion by both directly and indirectly increasing urate reabsorption and decreasing urate secretion. Patients who have a history of gout should be monitored when loop diuretics are administered.

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Ototoxicity

Ears with a Toxic-green-glow

Ototoxicity, or damage to the ear, is a serious, but rare adverse effect of loop diuretics. Symptoms may be limited to tinnitus and vertigo, but serious cases can result in deafness.

Hypocalcemia

Hippo-calcified-cow

Loop diuretics also inhibit calcium reabsorption in the kidney, and can lead to hypocalcemia. This occurs because calcium reabsorption in the thick ascending limb is dependent on an electrochemical potential difference, which is normally maintained by the Na-K-2Cl symporter. When this symporter is inhibited, there is decreased calcium resorption.

Hypokalemia

Hippo-banana

Because loop diuretics prevent reabsorption of sodium and chloride ions in the loop of Henle, there is increased sodium and water that passes through the collecting tubules in the kidney. This increase in distal tubular sodium concentration stimulates the aldosterone-sensitive sodium pump to increase sodium reabsorption in exchange for potassium and hydrogen ions, which are lost to the urine. Also, volume depletion due to increased urine output causes further increased secretion of aldosterone which further increases the secretion of potassium into the collecting duct and into the urine. It is via these mechanisms that patients develop hypokalemia while taking loop diuretics.

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