

## Furosemide

### - Drug Information

#### **Brand Names:**

Lasix®, Diuride®, Disal®, Salix™, Furoject, Equi-Phar™, Furotabs

#### **Pharmacology:**

Loop diuretic-related in structure to sulfonamides-reduces the absorption of electrolytes and increase the renal excretion of water and electrolytes.

#### **Indications:**

Reduces preload and pulmonary edema in CHF, used as a general diuretic in the treatment of uremia and other diseases that benefit from diuresis.

Also used in the treatment of post parturient udder edema in cattle.

Also used to prevent exercise induced pulmonary hemorrhage in race horses.

#### **Contraindications:**

##### **- General**

Contraindicated in patients with known sensitivity to this type of drug.

Contraindicated in anuria and in progressive renal failure if azotemia is worsening .

Use with caution in patient with liver disease, electrolyte or water imbalance and diabetes mellitus.

Patients with sensitivity to sulfonamides may have sensitivity reactions to furosemide.

Contraindicated in pregnancy-may cause fetal abnormalities.

##### **- Large Animal**

- Horse

Do not use in horses intended for human consumption.

#### **Interactions:**

##### **- General Interactions**

No identified General Interactions at time of publishing.

##### **- Category Interactions**

- ACE inhibitor

Use conservative initial doses when also starting furosemide - may cause hemodynamic changes that can lead to acute renal failure.

- Aminoglycoside Antibiotic

Nephrotoxicity is enhanced with furosemide.

- Corticosteroid

Hypokalemia risk is increased with corticosteroids.

- Diuretic

Additive diuresis is expected with other diuretics.

- Muscle relaxant

May reduce muscle relaxation effect of tubocurarine.

- Nephrotoxic drug

Use with caution with other nephrotoxic drugs.

- Ototoxic drug

Use with caution with other ototoxic drugs.

- Protein bound drug

May displace other highly protein bound drugs resulting in increased levels of both.

##### **- Drug Interactions**

- Aminophylline

May enhance the effect of theophylline.

- Amphotericin B

Hypokalemia risk is increased with amphotericin B.

- Aspirin / Acetylsalicylic acid

Aspirin competes for excretion sites-dose may need to be adjusted.

- Corticotropin (ACTH)

Hypokalemia risk is increased with corticotropin.

- Digoxin

Increases serum digoxin levels. Also can lead to hypokalemia and hypomagnesemia both of which exacerbate the cardiac toxicity of digoxin. Can also lead to pre renal azotemia which could cause decreased digoxin excretion. Monitor digoxin levels closely.

- Insulin

May alter the insulin requirements of diabetics.

- Lidocaine (systemic)

Hypokalemia secondary to furosemide can blunt the antiarrhythmic effects of lidocaine. Serum potassium should be evaluated in patients with ventricular arrhythmias and potassium supplementation instituted if patients do not respond to lidocaine.

- Potassium bromide and Sodium bromide

Furosemide will increase the renal loss of bromides and lower serum bromide levels and could result in break through seizures.

- Succinylcholine chloride

May increase the effect of succinylcholine.

- Theophylline

May enhance the effect of theophylline.

### Adverse Effects:

#### - General

May cause electrolyte and fluid imbalance-monitor hydration status carefully and electrolytes-particularly potassium, calcium and sodium.

May cause increased thirst, lethargy, drowsiness, restlessness, fatigue, increased heart rate, vomiting, diarrhea and loss of appetite.

Ototoxicity is possible at high dose IV therapy.

Weakness, anemia and leukopenia are also possible.

#### - Small Animal

- Cat

Ototoxicity is possible, especially in cats at high dose IV therapy.

### Dosages:

#### - General

For specific information regarding protocols, see specialized reference material.

Animals must drink adequate amounts of water or severe dehydration may result. The credo for furosemide therapy is: "Use as much as the case requires, and as little as necessary". Prior to therapy obtain serum chemistry and full urinalysis

#### - Small Animal

- Dog

As a general diuretic: 2.2 - 4.4 mg/kg once or twice daily at 6 - 8 hour intervals by mouth, IV or IM

For cardiogenic or pulmonary edema: For adjunctive therapy of CHF: 0.5 - 2 mg/kg by mouth per day

For severe pulmonary edema: Up to 7.7 mg/kg IV or IM every 1 - 2 hours until respiratory rate and/or respiratory character improves.

For heart failure (oral dosing; often in combination with an ACE inhibitor and digoxin): 1.1 mg/kg by mouth every other day for very mild heart failure to 4.4 mg/kg by mouth every 8 hours for severe heart failure.

For chronic maintenance therapy: Usually start at 2 mg/kg by mouth every 12 hours, but will adjust as necessary. Rarely go above 4 mg/kg by mouth every 8 hours. If case requires more than this dosage, add hydrochlorothiazide at 2 - 4 mg/kg by mouth every 12 hours. However at this point prognosis is poor.

For hypercalcemia/hypercalciuric nephropathy: Patient should be well hydrated before therapy. Give 5 mg/kg bolus IV, then begin 5 mg/kg/hour infusion. Maintain hydration status and electrolyte balance with normal saline with KCl added. Furosemide generally only reduces serum calcium levels by only 3 mg/dL.

For acute renal failure/uremia: After replacing fluid deficit, give furosemide at 2 mg/kg IV. If no diuresis within 1 hour, repeat dose at 4 mg/kg IV. If no response within 1 hour, give another dose at

6 mg/kg IV. The use of low dose DOPamine as adjunctive therapy is often recommended. (see DOPamine for details)

To promote diuresis in hyperkalemic states: 2 mg/kg IV; attempted if mannitol is ineffective after one hour

As a diuretic for the treatment of ascites: 1 - 2 mg/kg by mouth, SQ once to twice daily

As an antihypertensive: 1 - 2 mg/kg by mouth twice daily

- Cat

As a general diuretic: 2 - 4 mg/kg one to two times daily at 6 - 8 hour interval by mouth, IM, IV

For cardiogenic or pulmonary edema: 0.5 - 2 mg/kg by mouth per day

For severe pulmonary edema: Up to 4.4 mg/kg IV or IM every 1 - 2 hours until respiratory rate and/or respiratory character improves.

For heart failure (oral dosing; often in combination with an ACE inhibitor and digoxin): 1.1 mg/kg by mouth every 2 - 3 days - 2.2 mg/kg every 8 - 12 hours. (May require doses up to 6.6 mg/kg every 12 hours or 15.4 mg/kg by mouth once a day for cats that are difficult to treat orally).

For chronic maintenance therapy: Usually start at 2 mg/kg by mouth every 12 hours, but will adjust as necessary. Rarely go above 4 mg/kg by mouth every 8 hours. If case requires more than this dosage, add hydrochlorothiazide at 2 - 4 mg/kg by mouth every 12 hours. However at this point prognosis is poor.

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To promote diuresis in hyperkalemic states: 2 mg/kg IV; attempted if mannitol is ineffective after one hour

As a diuretic for the treatment of ascites: 1 - 2 mg/kg by mouth, SQ once to twice daily

As an antihypertensive: 1 - 2 mg/kg by mouth twice daily

- Birds (small)

0.05 mg/300gm IM twice daily. \*Lories are very sensitive to this dose and can be easily overdosed

- Rodent

Mice, Rats, Gerbils: 5 - 10 mg/kg every 12 hours

- Rabbit

For CHF: 2 - 5 mg/kg by mouth, SQ, IM or IV every 12 hours

For pulmonary edema: 1 - 4 mg/kg IV or IM every 4 - 6 hours

- Reptiles

5 mg/kg IV, IM as needed

- Guinea Pig

Guinea pigs: 5 - 10 mg/kg every 12 hours

- Ferret

For adjunctive therapy for heart failure: 2 - 3 mg/kg IM or IV initially for fulminant CHF; 1 - 2 mg/kg by mouth every 12 for long-term maintenance therapy

- Hamster

Hamsters: 5 - 10 mg/kg every 12 hours

**- Large Animal**

- Cattle

500 mg once daily or 250 mg twice daily or 2.2 - 4.4 mg/kg twice daily IV. No longer than 48 hours post parturient

- Horse

For adjunctive therapy for congestive heart failure: Initially, 1 - 2 mg/kg IM or IV every 6 - 12 hours to control edema. Long-term therapy: 0.5 - 2 mg/kg by mouth or IM every 8 - 12 hours

For adjunctive therapy of acute renal failure: 2 - 4 mg/kg every 6 hours

For epistaxis prevention: (Note: Refer to state guidelines for use of furosemide in racing animals)

0.3 - 0.6 mg/kg 60 - 90 minutes prior to race OR 250 mg IV 4 hours prior to racing

**Special Notes:**

None