**Furosemide** (fur-oh-se-mide)

**Lasix**

**Classification**
Therapeutic: diuretics
Pharmacologic: loop diuretics

**Pregnancy Category C**

**Indications**
Edema due to heart failure, hepatic impairment or renal disease. Hypertension.

**Action**
Inhibits the reabsorption of sodium and chloride from the loop of Henle and distal renal tubule. Increases renal excretion of water, sodium, chloride, magnesium, potassium, and calcium. Effectiveness persists in impaired renal function.

**Therapeutic Effects:** Diuresis and subsequent mobilization of excess fluid (edema, pleural effusions). Decreased BP.

**Pharmacokinetics**
**Absorption:** 60–67% absorbed after oral administration (q in acute HF and in renal failure); also absorbed from IM sites.

**Distribution:** Crosses placenta, enters breast milk.

**Protein Binding:** 91–99%.

**Metabolism and Excretion:** Minimally metabolized by liver, some nonhepatic metabolism, some renal excretion as unchanged drug.

**Half-life:** 30–60 min (q in renal impairment).

**Time/Action Profile (diuretic effect)**

<table>
<thead>
<tr>
<th>ROUTE</th>
<th>ONSET</th>
<th>PEAK</th>
<th>DURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>PO</td>
<td>30–60 min</td>
<td>1–2 hr</td>
<td>6–8 hr</td>
</tr>
<tr>
<td>IM</td>
<td>10–30 min</td>
<td>unknown</td>
<td>4–8 hr</td>
</tr>
<tr>
<td>IV</td>
<td>5 min</td>
<td>30 min</td>
<td>2 hr</td>
</tr>
</tbody>
</table>

**Contraindications/Precautions**

Contraindicated in: Hypersensitivity; Cross-sensitivity with thiazides and sulfonamides may occur; Hepatic coma or anuria; Some liquid products may contain alcohol, avoid in patients with alcohol intolerance.

Use Cautiously in: Severe liver disease (may precipitate hepatic coma, concurrent use with potassium-sparing diuretics may be necessary); Electrolyte depletion; Diabetes mellitus; Hypokalemia (q risk of arrhythmia); Severe renal impairment (q risk of toxicity); OR; Lactation; Safety not established; Podal: q risk for renal calculi and patent ductus arteriosis in premature neonates. Gert: May have q risk of side effects, especially hypokalemia and electrolyte imbalance, at usual doses.

**Adverse Reactions/Side Effects**
CNS: Blurred vision, dizziness, headache, vertigo.

EENT: Hearing loss, tinnitus.

CV: Hypotension.

GI: Anorexia, constipation, diarrhea, dry mouth, dyspepsia, lactic acidosis, pancreatitis, proctitis, rectal, ulcers, iritis, iridocyclitis, retinopathy, Stevens-Johnson syndrome, toxic epidermal necrolysis.

GU: BUN, excessive urination, nephrocalcinosis.

Derm: Erythema multiforme, Stevens-Johnson syndrome, toxic epidermal necrolysis, photosensitivity, pruritus, rash, urticaria.

Endo: Hypercholesterolemia, hyperglycemia, hyperuricemia.

F and E: dehydration, hypo–calcemia, hypochloremia, hypokalemia, hyponatremia, hypovolemia, metabolic alkalosis.

Hemat: Aplastic anemia, agranulocytosis, hemolytic anemia, leukopenia, thrombocytopenia.

MS: Muscle cramps.

Neuro: Paresthesia.

Misc: Fever.

**Interactions**

Drug–Drug: q risk of hypotension with antihypertensives, nitrates, or acute ingestion of alcohol; q risk of hypokalemia with other diuretics, amphetamines, stimulants, insulin, and corticosteroids. Hypokalemia may q risk of digoxin toxicity and q risk of arrhythmias in patients taking drugs that prolong the QT interval. Lactation: May cause hyperbilirubinemia in breastfed infants. q risk of lithium toxicity with lithium; q risk of nephrotoxicity with NSAIDS, effects of furosemide. May q risk of methotrexate toxicity; effects of furosemide when given at same time as sulfa drugs, diuretics, or corticosteroids; q risk of salicylate toxicity (with use of high-dose sulfonamide therapy). Concurrent use with cyclosporine may q risk of gouty arthritis.

Route/Dosage

**Edema**

**PO (Adults):** 20–80 mg/day as a single dose initially, may repeat in 6–8 hr; may q dose by 20–40 mg q 6–8 hr until desired response. Maintenance doses may be given once or two times daily (doses up to 2.5 g/day have been used in patients with HF or renal disease). Hypertension—40–60 mg daily initially (when added to regimen). q dose of
other antihypertensives by 50%); adjust further dosing based on response. Hypercalcem- 

icemia— PO (Children): 120 mg/day in 1–3 doses.

PO (Neonates): 1–4 mg/kg/dose q 6–12 hr.

IV (Children): 1–2 mg/kg/dose q 6–12 hr.

IV (Neonates): 1–2 mg/kg/dose q 12–24 hr.

Hypertension

PO (Adults): 40 mg twice daily initially (when added to regimen, p.d. dose of other anti-

hypertensives by 50%); adjust further dosing based on response.

NURSING IMPLICATIONS

Assessment

Assess fluid status. Monitor daily weight, intake and output ratios, amount and location of edema, lung sounds, skin turgor, and mucous membranes. Notify health care professional if thirst, dry mouth, lethargy, weakness, hypotension, or oliguria occurs.

Monitor BP and pulse before and during administration. Monitor frequency of prescription refills to determine compliance in patients treated for hypertension.

Geri:

Diuretic use is associated with increased risk for falls in older adults. Assess falls risk and implement fall prevention strategies.

Assess patients receiving digoxin for anorexia, nausea, vomiting, muscle cramps, paresthesia, and confusion. Patients taking digoxin are at increased risk of digoxin toxicity because of the potassium-depleting effect of the diuretic. Potassium supplements or potassium-sparing diuretics may be used concurrently to prevent hypokalemia.

Assess patient for tinnitus and hearing loss. Audiometry is recommended for patients receiving prolonged high-dose IV therapy. Hearing loss is most common after rapid or high-dose IV administration in patients with decreased renal function or those taking other ototoxic drugs.

Lab Test Considerations:

Monitor electrolytes, renal and hepatic function, serum glucose, and uric acid levels before and periodically throughout therapy. Commonly ↓ serum potassium. May cause ↓ serum sodium, calcium, and magnesium concentrations. May also cause ↑ BUN, serum glucose, creatinine, and uric acid levels.

Potential Nursing Diagnoses

Excess Fluid Volume (Side Effects)

Implementation

Do not confuse Lasix with Zemox.

If administering twice daily, give last dose no later than 5 pm to minimize disruption of sleep cycle.

IV route is preferred over IM route for parenteral administration.

PO: May be taken with food or milk to minimize gastric irritation. Tablets may be crushed if patient has difficulty swallowing.

Do not administer discolored solution or tablets.

IV Administration

Direct IV: Administer undiluted (larger doses may be diluted and administration time to a maximum of 500 mg/min) in adults and children >25 kg.

Concentration: 10 mg/mL.

Rate: Administer at a rate not exceeding 15 mg/min.

Pedi: Administer at a maximum rate of 0.5–1 mg/kg/min (for doses >120 mg) with infusion not exceeding 10 min.

Intermittent Infusion: Dilute larger doses in 50 mL of D5/0.9%, D5/10%, D5/20%, D5/0.9% NaCl, D5/8.4%, D5/1.5%, or LR. Infusion stable for 24 hr at room temperature. Do not refrigerate. Protect from light.

Concentration: 1 mg/mL.

Rate: Administer at a rate not exceeding 4 mg/min (for doses >120 mg) in adults to prevent ototoxicity. Pedi: not to exceed 1 mg/kg/min with infusion not exceeding 10 min. Use an infusion pump to ensure accurate dose.

Y-Site Compatibility: aminosalicylates, alfentanil, allopurinol, alprazolam, amiodarone, amikacin, amoxicillin, amphotericin B cholesteryl, amphotericin B lipid complex, amphotericin B liposome, anidulafungin, argatroban,
CONTINUED

furosemide

ascorbic acid, atropine, azathioprine, aztreonam, bleomycin, bleomycin, benzylate, calcium chloride, calcium gluconate, carbenoxolone, carmustine, carprofen, cephalothin, cefazolin, cefepime, cefoperazone, cefotaxime, cefotetan, cefotaxime, cefoxitin, cefpodoxime, cefuroxime, chloramphenicol, clindamycin, cytarabine, cyclophosphamide, cyclosporine, dexamethasone, dexmedetomidine, digoxin, doxorubicin, dopamine, dapsone, diphenhydramine, dipyrone, divalproex, domperidone, drotaverine, etoposide, esomeprazole, fentanyl, fludarabine, fluorouracil, folic acid, foscarnet, ganciclovir, granisetron, griseofulvin, hydrocortisone sodium succinate, hydromorphone, ibuprofen, ifosfamide, imipenem/cilastatin, indomethacin, ketorolac, leucovorin calcium, lidocaine, linezolid, lorazepam, mannitol, mechlorethamine, melphalan, meropenem, methotrexate, methylprednisolone, metoprolol, metronidazole, micafungin, mitomycin, multivitamins, nafcillin, naloxone, nitroprusside, octreotide, oxacillin, oxaliplatin, oxytocin, paclitaxel, palonosetron, pamidronate, pemetrexed, penicillin G, pentobarbital, phenobarbital, phytonadione, piperacillin/tazobactam, potassium acetate, potassium chloride, procainamide, propylthiouracil, ranitidine, remifentanil, sargramostim, sodium acetate, sodium bicarbonate, streptokinase, succinylcholine, sufentanil, teniposide, theophylline, thiotepa, ticarcillin/clavulanate, tigecycline, tirofiban, tobramycin, vitamin B complex with C, voriconazole, zoledronic acid.

● Y-Site Incompatibility: alemtuzumab, amsacrine, atracurium, benztropine, buprenorphine, caspofungin, chlorpromazine, ciprofloxacin, dantrolene, dexrazoxane, diazepam, diazoxide, diltiazem, diphenhydramine, dolasetron, doxycycline, droperidol, eptifibatide, erythromycin, esmolol, fenoldopam, filgrastim, gemcitabine, gentamicin, glycopyrrolate, haloperidol, hydroxyzine, idarubicin, irinotecan, ketamine, levofloxacin, metaraminol, methyldopate, midazolam, milrinone, mitoxantrone, moxifloxacin, mycophenolate, nalbuphine, nesiritide, nicardipine, ondansetron, pancuronium, papaverine, pentamidine, pentazocine, phentolamine, phenylephrine, phenytoin, prochlorperazine, promethazine, protamine, pyridoxime, quinupristin/dalfopristin, rituximab, rocuronium, telavancin, thiamine, trastuzumab, trimethoprim/sulfamethoxazole, vancomycin, voriconazole, warfarin, withalbine, zosulidine.

Patient/Family Teaching

● Instruct patient to take furosemide as directed. Take missed doses as soon as possible; do not double doses.

● Caution patient to change positions slowly to minimize orthostatic hypotension. Caution patient that the use of alcohol, exercise during hot weather, or standing for long periods during therapy may enhance orthostatic hypotension.

● Instruct patient to consult health care professional regarding a diet high in potassium.

● Advise patient to contact health care professional of weight gain more than 5 lbs in 1 day.

● Instruct patient to notify health care professional of all Rx or OTC medications, vitamins, or herbal products being taken and to consult health care professional before taking any OTC medications concurrently with this therapy.

● Instruct patient to notify health care professional of medication regimen before treatment or surgery.

● Advise patient to use sunscreen and protective clothing to prevent photosensitivity reactions.

● Advise patient to contact health care professional immediately if rash, muscle weakness, cramps, nausea, dizziness, numbness, or tingling of extremities occurs.

● Instruct patient to monitor blood glucose closely; may cause increased blood glucose levels.

● Emphasize the importance of routine follow-up examinations.

● Urine: Caution elderly patients or their caregivers about increased risk for falls. Suggest strategies for fall prevention.

● Hypertension: Advise patients on antihypertensive regimen to continue taking medication even if feeling better. Furosemide controls but does not cure hypertension.

● Reinforce the need to continue additional therapies for hypertension (weight loss, exercise, restricted sodium intake, stress reduction, regular exercise, moderation of alcohol consumption, cessation of smoking).

● Advise diabetic patients to monitor blood glucose closely as may cause increased blood glucose levels.

● Advise patient to consult health care professional immediately if rash, muscle weakness, cramps, nausea, dizziness, numbness, or tingling of extremities occurs.

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Evaluation/Desired Outcomes
- Decrease in edema.
- Decrease in abdominal girth and weight.
- Increase in urinary output.
- Decrease in BP.

Why was this drug prescribed for your patient?