Furosemide – Standard concentration

Newborn use only

2026

<table>
<tr><td>Indication</td><td>Heart failure.
Fluid overload.
Short-term treatment in infants with or developing chronic lung disease.
Oliguric renal failure.
Diuresis renography.</td></tr>
<tr><td>Action</td><td>Potent loop diuretic. Inhibits sodium and chloride absorption in the ascending limb of the loop of Henle and in the proximal and the distal tubules.
Furosemide causes urinary losses of water, sodium (increases fractional excretion of sodium by 20–25%),[2] potassium and chloride. Urinary losses of calcium and magnesium and urinary pH are increased.</td></tr>
<tr><td>Drug type</td><td>Loop diuretic</td></tr>
<tr><td>Trade name</td><td>IV: Lasix Solution for Injection, Lasix High Dose Concentrate for Infusion, Furosemide-Baxter Solution for Injection.
Oral: Lasix Oral Solution (refrigerated), Lasix Oral Solution (not requiring refrigeration).</td></tr>
<tr><td>Presentation</td><td>IV: 20 mg/2 mL, 40 mg/4 mL or 250 mg/25 mL ampoule.
Oral: 10 mg/mL, 30 mL bottle.
Note: Commercial preparation “Lasix Oral Solution (not requiring refrigeration)” contains 12.7% v/v alcohol. Non-alcohol containing suspension can be compounded by local pharmacy.</td></tr>
<tr><td>Dose</td><td>IV or PO*: 1 to 2 mg/kg/dose.
Dose interval
<table>
<tr><th>Corrected gestational age/Postmenstrual age</th><th>Interval</th></tr>
<tr><td>Preterm infant < 34 weeks</td><td>Every 24 hours</td></tr>
<tr><td>Preterm infant ≥ 34 weeks</td><td>12–24 hours</td></tr>
<tr><td>Term infant 0–30 days</td><td>Every 12 hours</td></tr>
<tr><td>Term infant > 30 days</td><td>8–12 hours</td></tr>
</table>
*PO: Dose may be increased up to maximum 6 mg/kg/dose in term infants with heart failure.

IV Infusion: 0.05 to 0.2 mg/kg/hour (approximately 1 to 5 mg/kg/day).
Dose may be increased to a maximum 0.4 mg/kg/hour on the advice of the renal physician.

Diuresis renography: 1 mg/kg stat.</td></tr>
<tr><td>Dose adjustment</td><td>Therapeutic hypothermia - No information.
ECMO – No information.
Renal impairment – Dose may need to be increased: Titrate according to clinical response.
Hepatic impairment – No information.</td></tr>
<tr><td>Maximum dose</td><td>IV: 2 mg/kg/dose
IV infusion: 0.4 mg/kg/hour
Oral: 6 mg/kg/dose</td></tr>
<tr><td>Route</td><td>IV or oral</td></tr>
<tr><td>Preparation</td><td><u>Oral:</u>
Use as supplied undiluted.

<u>IV bolus</u>:
Give undiluted. If dilution required draw up 0.5 mL (5 mg of furosemide) and add 9.5 mL glucose 5%, glucose 10% or sodium chloride 0.9% to make a final volume of 10 mL with a concentration of 0.5 mg/mL.

<u>IV infusion</u>:
Note: Refer to Appendix for tables to assist with concentration selection.

NOTE: Use the smallest volume syringe available/suitable for drawing up the drug for the preparation. (e.g. for <1 mL draw up – use 1 mL syringe). For 10 mL syringe - Recommend using syringe that has markings at 0.2mL increments

The standard concentrations outlined in this monograph were developed taking into consideration a minimum patient weight of 0.4 kg and a minimum infusion rate of 0.1 mL/hour. For patients weighing less than 0.4kg, further dilution may be required.</td></tr>
</table>

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Prime the line as close to the entry point as possible to reduce the dead space – however, care should be taken not to deliver excess volume.

Weight suggestions for infusion concentrations below are a guide only. Clinicians may choose infusion concentration different to the suggested based on expected dose and the corresponding 24-hour fluid volumes

Furosemide concentration	0.2 mg/mL	0.5 mg/mL	1 mg/mL	3mg/mL
Infant weight (Guide Only)	<1 kg	1-3 kg	>3 kg	Fluid restricted
0.05 mg/kg/hour is equal to	0.25 mL/kg/hour	0.1 mL/kg/hour	0.05 mL/kg/hour	0.0167 mL/kg/hour

20 mL Syringe

It is a 2-step dilution for the 0.2 mg/mL concentration. It is a 1-step dilution for the 1 mg/mL concentration.
Step 1: Draw up furosemide and add compatible fluid* to make a diluted solution as per table below:

Furosemide concentration	0.2 mg/mL	0.5 mg/mL	1 mg/mL	3 mg/mL
Volume of furosemide (10 mg/mL)	1 mL (10 mg)	1 mL (10 mg)	2 mL (20 mg)	6 mL (60 mg)
Volume of compatible fluid*	9 mL	19 mL	18 mL	14 mL
Total volume	10 mL **(1 mg/mL)**	20 mL	20 mL	20 mL

Step 2: Draw up diluted furosemide and add compatible fluid* as per table below to make a final volume of 20 mL

Furosemide concentration	0.2 mg/mL
Volume of diluted furosemide from step 1	4 mL (4 mg)
Volume of compatible fluid*	16 mL
Total volume	20 mL

*Compatible fluid: glucose 5%, glucose 10% or sodium chloride 0.9%

50 mL Syringe

Draw up furosemide and add compatible fluid* as per table below to make a final volume of 50 mL

Furosemide concentration	0.2 mg/mL	0.5 mg/mL	1 mg/mL	3 mg/mL
Volume of furosemide (10 mg/mL)	1 mL (10 mg)	2.5 mL (25 mg)	5 mL (50 mg)	15 mL (150 mg)
Volume of compatible fluid*	49 mL	47.5 mL	45 mL	35 mL
Total volume	50 mL	50 mL	50 mL	50 mL

*Compatible fluid: glucose 5%, glucose 10% or sodium chloride 0.9%

Administration	IV bolus over 2–4 minutes: maximum rate not to exceed 0.5 mg/kg/minute or 4 mg/minute. For diuresis renography – dose should be given as a push.[1] IV infusion: Via syringe pump Oral: Solution may be administered without regard to feeds.
Monitoring	Urine output, weight, serum sodium and potassium. Screening for nephrocalcinosis may be required for preterm infants on prolonged therapy.

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Contraindications	Known hypersensitivity to furosemide or sulfonamides or any of the inactive ingredients. Severe hypokalaemia, hyponatraemia, hypovolaemia, dehydration or hypotension must be regarded as contraindications until serum electrolytes, fluid balance and blood pressure have been restored to normal levels. Severe jaundice at risk of bilirubin encephalopathy.
Precautions	Commercially available oral furosemide solution contains ethanol and 2 mg/kg/day of solution equates to 1.4 mL/kg/week ethanol intake [equivalent to 1 unit alcohol/week for a man weighing 70 kg]. If increasing azotaemia and oliguria occur during treatment of severe progressive renal disease, discontinue furosemide. Jaundice – furosemide may displace bilirubin from albumin. However, bilirubin displacement is negligible with standard doses. Renal calcifications have occurred in some severely premature infants treated with intravenous Lasix for oedema due to patent ductus arteriosus and hyaline membrane disease. The concurrent use of chlorothiazides has been reported to decrease hypercalciuria and to dissolve some calculi.
Drug interactions	Furosemide can cause the depletion of potassium and magnesium, which can predispose patients to serious cardiac arrhythmias, particularly in the presence of digitalis therapy. The risk of electrolyte depletion is markedly enhanced when 2 diuretics are used in combination. May prolong action of muscle relaxants. Avoid concomitant usage of aminoglycosides to avoid ototoxicity. Anticonvulsants may decrease the response to furosemide (frusemide). Use of furosemide (frusemide) concomitantly with chloral hydrate is not recommended.
Adverse reactions	Furosemide is associated with renal losses of calcium, sodium, chloride and potassium. Prolonged and higher doses of furosemide are associated with ototoxicity and nephrocalcinosis.
Overdose	AUSTRALIA Contact the Poisons Information Centre on **13 11 26** for information on the management of overdose. NEW ZEALAND Contact the National Poisons Centre on **0800 764 766** for information on the management of overdose.
Compatibility	**Fluids**: Glucose 5%, glucose 10%, glucose 20%, sodium chloride 0.9%. **PN at Y-site**: Compatible with lipid emulsions **Y-site**[24]: Aciclovir, alprostadil, amikacin, amphotericin B lipid complex, amphotericin B liposome, atenolol, atropine, aztreonam, benzylpenicillin, calcium chloride, calcium gluconate, cefazolin, cefepime, cefotaxime, ceftazidime, ceftriaxone, chloramphenicol sodium succinate, chlorothiazide, clindamycin, cloxacillin, dexamethasone, dexmedetomidine, digoxin, enalaprilat, epinephrine, epoetin alfa, fentanyl, folic acid, fosphenytoin, ganciclovir, heparin, hydrocortisone sodium succinate, ibuprofen lysine, imipenem-cilastatin, indomethacin, lidocaine, linezolid, meropenem, methylprednisolone sodium succinate, metoprolol, metronidazole, naloxone, nitroprusside sodium, octreotide, pamidronate, paracetamol, pentobarbital, phenobarbital, piperacillin-tazobactam, potassium acetate, potassium chloride, propofol, propranolol, ranitidine, sodium acetate, sodium bicarbonate, succinylcholine, ticarcillin-clavulanate, tobramycin, urokinase, voriconazole. **Variable compatibility:** Amiodarone, amphotericin B conventional colloidal, ampicillin, azithromycin, dobutamine, dopamine, erythromycin lactobionate, esmolol, fluconazole, gentamicin, hydralazine, insulin, labetolol, magnesium sulfate, midazolam, morphine, nitroglycerin, norepinephrine, pantoprazole, phenylephrine, remifentanil, thiopental, vasopressin.
Incompatibility	**Fluids:** No information. Do not mix furosemide with solutions that have a pH of less than 5.5. **PN at Y-site**: Variable compatibility with parenteral nutrition solutions. **Y-site**[24]: Atracurium, caffeine citrate, diazepam, diazoxide, filgrastim, glycopyrronium, hyaluronidase, ketamine, milrinone, pancuronium, phenytoin, protamine, pyridoxine, rocuronium, sildenafil citrate, sulfamethoxazole-trimethoprim, thiamine, vancomycin, vecuronium, verapamil.
Stability	Do not use if solution is discoloured. Diluted IV solution: Stable for 24 hours at 2−25°C (preferred storage is 2-8°C). Oral solution: Commercial preparation "Lasix"- Discard 8 weeks after opening. Compounded suspension – check with local Pharmacy.
Storage	Ampoule: Store below 25°C. Protect from light. Occasionally crystal deposits may be seen when ampoules are stored at low temperatures. Dissolve crystals by warming to 40°C and injection may be used. Discard solutions that are yellow.

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	Oral solution: Commercial preparation – refer to product label for instructions regarding storage conditions. Compounded suspension – check with local Pharmacy.
Excipients	Lasix: sodium chloride, sodium hydroxide, water for injections (contains 0.16 mmol/mL of sodium). Lasix High Dose Concentrate: Mannitol, sodium hydroxide, water for injections (contains 0.03 mmol/mL of sodium). Furosemide-Baxter: sodium chloride, sodium hydroxide, hydrochloric acid, water for injections. Lasix Oral Solution (refrigerated): sorbitol, glycerol, sodium hydroxide, methyl hydroxybenzoate, potassium sorbate, polysorbate 80, butylated hydroxytoluene, butylated hydroxyanisole, ethanol, Tetrarome Orange 987431 (PI 11335), quinoline yellow, purified water. Lasix Oral Solution (not requiring refrigeration): sorbitol solution (70 per cent) (non-crystallising), glycerol, sodium hydroxide, methyl hydroxybenzoate, propyl hydroxybenzoate, ethanol, quinoline yellow, sunset yellow FCF, Trusil Orange Flavour 10814413 (PI 106046), purified water.
Special comments	Loop diuretics are preferred for initial treatment of heart failure as they have a greater effect on sodium excretion compared to distal diuretics.[2] Potassium deficits can be corrected by the short-term use of potassium supplements. Concomitant administration of a potassium-retaining agent such as spironolactone can prevent potassium depletion in most infants taking a loop diuretic. Alternate day dosing may be considered to reduce the risk of electrolyte and mineral abnormalities. Plasma $t_{½}$ of furosemide is 7.7–26.8 hours in neonates. It is longer in immature infants (mean $t_{½}$ > 20 hours).[22] The $t_{½}$ is prolonged by renal and hepatic insufficiency. Blood concentrations exceeding 0.05 mg/mL may be associated with ototoxicity. Administration of high doses at a rate faster than 4 mg/minute may result in tinnitus, vertigo and deafness, especially when combined with other ototoxic drugs or in patients with severe renal impairment.
Evidence	**Efficacy:** **Heart failure:** Controlled trials have demonstrated diuretics increase urinary sodium excretion and decrease physical signs of fluid retention in patients with HF. In short-term studies, diuretic therapy led to a reduction in jugular venous pressures, pulmonary congestion, peripheral oedema and body weight; all of which were observed within days of initiation of therapy. In intermediate-term studies, diuretics have been shown to improve cardiac function, symptoms and exercise tolerance in patients with HF. There have been no long-term studies of diuretic therapy in HF and thus, their effects on morbidity and mortality are not known.[2] **Preterm infants with or developing chronic lung disease (CLD):** In preterm infants < 3 weeks of age developing CLD, furosemide administration has either inconsistent effects or no detectable effect. In infants > 3 weeks of age with CLD, a single intravenous dose of 1 mg/kg of furosemide improves lung compliance and airway resistance for one hour. Chronic administration of furosemide improves both oxygenation and lung compliance. Routine or sustained use of systemic loop diuretics in infants with (or developing) CLD cannot be recommended based on current evidence.[3] (LOE II, GOR C) **Aerosolised diuretics for preterm infants with (or developing) chronic lung disease:** In preterm infants > 3 weeks with CLD, administration of a single dose of aerosolised furosemide improves pulmonary mechanics. In view of the lack of data from randomised trials concerning effects on important clinical outcomes, routine or sustained use of aerosolised loop diuretics in infants with (or developing) CLD cannot be recommended based on current evidence.[4] (LOE I GOR C) **Term infants with transient tachypnoea:** Diuretics had no effect in the treatment of transient tachypnoea of the newborn.[5] (LOE I, GOR B) **Preterm infants with respiratory distress (RDS):** There are no data to support routine administration of furosemide in preterm infants with RDS and it may increase the risk of developing a symptomatic patent ductus arteriosus.[6] (LOE I GOR B) **Electively transfused preterm infants beyond the first week of life:** Furosemide resulted in a reduction in post transfusion FiO_2 (0.29 versus 0.27) which may be clinically insignificant.[7] (LOE II, GOR C) **Furosemide for symptomatic patent ductus arteriosus in indomethacin-treated infants:** Use of furosemide in combination with indomethacin increased the incidence of acute renal failure and did not affect the PDA closure rate.[8,9] (LOE II, GOR C) **Infants with post-haemorrhagic ventricular dilatation:** Diuretic therapy is neither effective nor safe in treating post-haemorrhagic ventricular dilatation.[10] (LOE I, GOR B) **Continuous infusion versus intermittent administration of furosemide:** The safety and benefits of continuous infusion of furosemide is unclear.[11–13] In adults and children, no significant increase in urine output except for when loading dose administered prior to infusion.[11] (LOE I, GOR C)

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Pharmacokinetics

Plasma $t_{½}$ of furosemide is 7.7–26.8 hours in neonates. It is lower in immature infants (mean $t_{½}$ > 20 hours)[22]. Drug accumulation may occur with 12 hour dosing especially in infants < 33 weeks PMA.[14] (LOE IV, GOR B)
The bioavailability of oral furosemide markedly reduced in preterm infants – estimated at 20%[15] compared to ~60% in adults.[16] 94% is plasma protein bound.[15] (LOE IV GOR C)
Furosemide is primarily cleared via renal secretion (60–70%).[16] Clearance is reduced in renal impairment.

Safety

Furosemide results in renal excretion of calcium, sodium, chloride and potassium.[17] Prolonged and high dose use of furosemide, especially in the context of other ototoxic treatments (including aminoglycosides), has been associated with ototoxicity.[18–20] Blood concentrations exceeding 0.05 mg/mL may be associated with ototoxicity.[14] (LOE III-2 GOR B). Prolonged furosemide treatment and treatment combined with acetazolamide is associated with nephrocalcinosis.[10, 21] (LOE I GOR B)
Alternate day furosemide may be associated with a lower risk of electrolyte and mineral abnormalities.[23]

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Appendix

Infusion tables to assist concentration selection

Table 1: Infusion rates when using furosemide concentration **0.2 mg/mL**

Rate (mL/hr)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Weight (kg)	**Approximate mg/kg/hour**									
0.5	0.04	0.08	0.12	0.16	0.2	0.24	0.28	0.32	0.36	0.4
1	0.02	0.04	0.06	0.08	0.1	0.12	0.14	0.16	0.18	0.2
1.5	0.01	0.03	0.04	0.05	0.07	0.08	0.09	0.11	0.12	0.13
2	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.1
2.5	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.06	0.07	0.08
3	0.01	0.01	0.02	0.03	0.03	0.04	0.05	0.05	0.06	0.07
3.5	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.05	0.06
4	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.05
4.5	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.04	0.04
5	0.00	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.04

Table 2: Infusion rates when using furosemide concentration **0.5 mg/mL**

Rate (mL/hr)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Weight (kg)	**Approximate mg/kg/hour**									
0.5	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1
1	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50
1.5	0.03	0.07	0.10	0.13	0.17	0.20	0.23	0.27	0.30	0.33
2	0.03	0.05	0.08	0.10	0.13	0.15	0.18	0.20	0.23	0.25
2.5	0.02	0.04	0.06	0.08	0.10	0.12	0.14	0.16	0.18	0.20
3	0.02	0.03	0.05	0.07	0.08	0.10	0.12	0.13	0.15	0.17
3.5	0.01	0.03	0.04	0.06	0.07	0.09	0.10	0.11	0.13	0.14
4	0.01	0.03	0.04	0.05	0.06	0.08	0.09	0.10	0.11	0.13
4.5	0.01	0.02	0.03	0.04	0.06	0.07	0.08	0.09	0.10	0.11
5	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10

Table 3: Infusion rates when using furosemide concentration **1 mg/mL**

Rate (mL/hr)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Weight (kg)	**Approximate mg/kg/hour**									
0.5	0.2	0.4	0.6	0.8	1	1.2	1.4	1.6	1.8	2
1	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
1.5	0.07	0.13	0.2	0.27	0.33	0.4	0.47	0.53	0.6	0.67
2	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5
2.5	0.04	0.08	0.12	0.16	0.2	0.24	0.28	0.32	0.36	0.4
3	0.03	0.07	0.1	0.13	0.17	0.2	0.23	0.27	0.3	0.33
3.5	0.03	0.06	0.09	0.11	0.14	0.17	0.2	0.23	0.26	0.29
4	0.03	0.05	0.08	0.1	0.13	0.15	0.18	0.2	0.23	0.25
4.5	0.02	0.04	0.07	0.09	0.11	0.13	0.16	0.18	0.2	0.22
5	0.02	0.04	0.06	0.08	0.1	0.12	0.14	0.16	0.18	0.2

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Table 4: Infusion rates when using furosemide concentration **3 mg/mL**
(fluid restricted patients)

Rate (mL/hr)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Weight (kg)	**Approximate mg/kg/hour**									
0.5	0.60	1.20	1.80	2.40	3	3.60	4.20	4.80	5.40	6
1	0.30	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3
1.5	0.20	0.40	0.60	0.80	1	1.20	1.40	1.60	1.80	2
2	0.15	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50
2.5	0.12	0.24	0.36	0.48	0.60	0.72	0.84	0.96	1.08	1.20
3	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1
3.5	0.09	0.17	0.26	0.34	0.43	0.51	0.60	0.69	0.77	0.86
4	0.08	0.15	0.23	0.30	0.38	0.45	0.53	0.60	0.68	0.75
4.5	0.07	0.13	0.20	0.27	0.33	0.40	0.47	0.53	0.60	0.67
5	0.06	0.12	0.18	0.24	0.30	0.36	0.42	0.48	0.54	0.60

$$\text{Rate (mL/hr)} = \frac{\text{Dose (mg/kg/hour) x Weight (kg)}}{\text{Concentration (mg/mL)}}$$

$$\text{Dose (mg/kg/hour)} = \frac{\text{Rate (mL/hr) x Concentration (mg/mL)}}{\text{Weight (kg)}}$$

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VERSION/NUMBER	DATE
Original 1.0	5/02/2026
Current 2.0	17/11/2026
REVIEW	5/02/2031

This standard concentration formulary has been developed by the ANMF standard concentration working group.
The working group (in alphabetical order): Mohammad Irfan Azeem, Susannah Brew, Cindy Chen, Michelle Jenkins, Kerrie Knox, Rebecca O'Grady

Authors Contribution

Original author/s	Srinivas Bolisetty, David Osborn
Evidence Review	David Osborn
Expert review	
Nursing Review	Celia Cunha da Silva
Pharmacy Review	Cindy Chen, Susannah Brew, Kerrie Knox
ANMF Group contributors	Nilkant Phad, Bhavesh Mehta, Amber Seigel, Rebecca Barzegar, Jutta van den Boom, Mohammed Irfan Azeem, Michelle Jenkins, Kerrie Knox, Cindy Chen, Thao Tran, Celia Cunha da Silva, Benjamin Emerson-Parker, Simarjit Kaur, Renae Gengaroli, Bryony Malloy, Gloria Yoo, Marguerite Mason-Elliott
Final editing	Thao Tran
Electronic version	Cindy Chen
Facilitator	Srinivas Bolisetty

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