Ballarat Health Services

DRUG GUIDELINE

FUROSEMIDE (Frusemide) – Intravenous

SCOPE (Area): **FOR USE IN:** Intensive Care Unit, ED, Coronary Care Unit, Theatre, CVS, General Wards, GH-B at Home
EXCLUSIONS: Paediatrics (seek Paediatrician advice)
SCOPE (Staff): Medical, Nursing and Pharmacy

BRAND NAMES
Lasix High Dose®. Lasix®. Generic brands.

PHARMACOLOGY AND PHARMACOKINETICS
Furosemide is a potent loop diuretic that inhibits reabsorption of sodium and chloride in the ascending loop of Henle and in both the proximal and distal tubules.

Onset of diuresis: within 5 minutes of IV administration.
Peak diuresis: within the first half hour of IV administration.
Duration of diuretic effect: approximately 2 hours (for IV bolus dosing).
Half-life: ranging up to 100 minutes (prolonged in renal or hepatic impairment).
Excretion: Predominantly renal. In patients with normal renal function, approximately 80% of an IV furosemide dose is excreted in the urine within 24 hours.

INDICATIONS
- For management of oedema in the context of fluid overload.

CONTRAINDICATIONS
- **Hypersensitivity to furosemide.**

PRECAUTIONS
- **Severe hyponatraemia, hypokalaemia, hypovolaemia or hypotension** - correct before using.
- **Ototoxicity –** usually associated with rapid injection or infusion, do not exceed the maximum rate.
- **Anuria –** if patient is anuric for longer than 24 hours they are unlikely to respond.
- **Renal impairment –** higher doses of furosemide are usually required in renal impairment, however renal function may worsen. Monitor electrolytes and creatinine carefully.
- **Hepatic impairment –** electrolyte imbalance may precipitate hepatic encephalopathy.
- **Hypersensitivity to sulfonamides –** cross-sensitivity between antimicrobial and non-antimicrobial sulfonamides is uncommon, however exercise care if adverse reaction was severe.
- **Prostatic obstruction or other blockage of urinary output** – may precipitate urinary retention.
- **Gout –** furosemide induced hyperuricaemia may aggravate gout.
- **Elderly –** more susceptible to electrolyte imbalance and orthostatic hypotension.
- **Systemic lupus erythromatosus –** furosemide may exacerbate or activate the condition.

PREGNANCY AND BREASTFEEDING

Seek specialist advice before prescribing, information may update regularly. Refer to the Royal Women's Pregnancy and Breastfeeding Medicines Guide for more information.

DRUG INTERACTIONS

- **NSAIDs (including selective COX-2 inhibitors) -** increased risk of nephrotoxicity with furosemide, as well as decreasing the diuretic effect and reducing renal function. Do not use.
- **Ototoxic or nephrotoxic drugs (e.g. gentamicin, vancomycin, cisplatin) –** combined use with furosemide further increases the risk of oto- or nephrotoxicity, especially with renal impairment.
- **Antihypertensives -** use with furosemide may cause a further decrease in blood pressure. Use combinations carefully (especially ACE inhibitors and sartans) and monitor.
- **Potassium lowering drugs (corticosteroids, beta agonists, IV amphotericin) –** combined use with furosemide increases the risk of hypokalaemia, monitor potassium carefully.
- **Drugs that prolong the QT interval –** increased risk of QT prolongation and torsades de pointes if furosemide induces hypokalaemia. Monitor serum potassium carefully.
- **Digoxin -** increased risk of digoxin toxicity associated if furosemide induces hypokalaemia. Monitor serum potassium carefully.
- **Lithium –** furosemide decreases the excretion of lithium and may increase the risk of lithium toxicity. Monitor lithium levels if combination is required.
- **Other diuretics –** co-administration may result in profound diuresis and possible serious electrolyte disturbances. Monitor blood pressure, electrolytes and renal function closely.
- **Phenytoin, methotrexate, probenecid –** competition with furosemide for active tubular secretion may decrease the effect of furosemide and/or increase the toxicity of these agents.
- **SGLT2 inhibitors** – may increase diuretic effect and risk of electrolyte disturbance.

DOSAGE AND ADMINISTRATION

Different doses and rates are administered in different ward areas. The Consultant (i.e. cardiology, general medicine, nephrology physicians, intensivists and emergency specialists) may request higher doses – see more information in relevant dosage boxes below.

To be administered via CVC, midline or peripheral vein.

All IV furosemide (bolus, intermittent infusion, continuous infusion) is to be given undiluted.

Doses above 80 mg and the 250 mg/25 mL ampoule are only to be administered as an infusion with a maximum rate of 4 mg/minute.

Bolus doses and intermittent infusions require a flush to avoid leaving part of the dose in the line given the small volumes involved, see below.

IV to Oral transition:
Once a patient's fluid status is improving, transition to oral furosemide may be necessary. Oral furosemide 40 mg is roughly equivalent to intravenous furosemide 20 mg.

There can be substantial variability in oral bioavailability, suggest transition to 1 to 2 times the IV dose and monitor for effect with titration as necessary. e.g. receiving 80mg BD intravenously, suggest 80 to 160 mg orally BD, with ongoing monitoring.

Note: Furosemide orders are not to be written as PO/IV, as doses are not equivalent.

FOR ALL WARDS AND GH-B AT HOME

IV Bolus (for doses up to 80 mg) – via Slow Push OR Alaris® Syringe Module:
Use furosemide 20 mg/2 mL ampoules undiluted to prepare injection.
Usual dose range: 20 – 80 mg (2 – 8 mL) undiluted up to four times a day.
Maximum rate: slow push over 2 to 5 minutes. This dose can be given by hand, or by Alaris® syringe module (a slower rate may be preferred in patients with labile blood pressure).
Maximum BOLUS dose: 80 mg (8 mL), doses above this must be given via intermittent infusion.
Usual maximum TOTAL dose in 24 hours: 320 mg, unless discussed with Consultant and pharmacist.
Flush: 5-10 mL of compatible fluid (e.g. sodium chloride 0.9%) as slow push over 2 to 5 mins.

IV Intermittent Infusion (for doses greater than 80 mg) – via Alaris® Syringe Module:
Use furosemide 20 mg/2 mL or 250 mg/25 mL ampoules undiluted to prepare infusion in luer lock syringe.
Frequency: daily to 4 hourly**.**
Final concentration: 10 mg/mL.
Maximum Rate: 4 mg/min (24 mL/hr).
Usual maximum INTERMITTENT infusion dose: 120 mg (12 mL).
Consultant maximum INTERMITTENT infusion dose: in cases of diuretic resistance, doses up to 250 mg (25 mL) may be requested by the Consultant – this requires documenting in the patient's notes.
Usual Maximum TOTAL dose in 24 hours: 360 mg.
Consultant maximum TOTAL dose in 24 hours: in cases of diuretic resistance, up to 500 mg TOTAL may be requested by the Consultant – this requires documenting in the patient's notes.
Flush: 5-10 mL of compatible fluid (e.g. sodium chloride 0.9%) at the same rate as the infusion, via syringe module. Label the syringe as per CPP0222 User Applied Labelling Of Injectable Medicines, Fluids And Lines.

FOR ACUTE WARDS AND CORONARY CARE UNIT (patients unresponsive to intermittent infusion)

IV continuous infusion – via Alaris® Syringe Module:
Requires Consultant approval
Must be prescribed on the Adult Intravenous Orders chart (MR/645.0).

Use furosemide 250 mg/25 mL ampoules to prepare infusion.
Furosemide 500 mg (50 mL from TWO ampoules) drawn up in a 50 mL luer lock syringe undiluted.
Total Volume: 50 mL.
Final concentration: 10 mg/mL.
Usual dose range: 10-20 mg/hr (1-2 mL/hr).
Maximum rate: 20 mg/hr (2 mL/hr).
Maximum TOTAL dose in 24 hours: 480 mg (48 mL).
Ceasing infusion: continuous infusion may be switched to intermittent dosing when appropriate OR continued until fluid status improves, then converted to oral therapy.

FOR ICU, ED, THEATRE, CVS ONLY

IV continuous infusion – via Alaris® Syringe Module:
Must be prescribed on the Adult Intravenous Orders chart (MR/645.0).

Use furosemide 250 mg/25 mL ampoules to prepare infusion.
Furosemide 500 mg (50 mL from TWO ampoules) drawn up in a 50 mL luer lock syringe undiluted.
Total Volume: 50 mL.
Final concentration: 10 mg/mL.
Usual dose range: 10-50 mg/hr (1-5 mL/hr).
Maximum rate: 100 mg/hr (10 mL/hr). If infusion has been running at 100 mg/hr for 4-6 hours with no response, furosemide is of no benefit and should be reviewed with the Medical team.
Maximum dose in 24 hours: 1000 mg (100 mL).
Ceasing infusion: In AKI, once urine output is greater than 50-100 mL/hr, decrease furosemide dose by 50% and reassess. In general, if polyuria (greater than 150-200 mL/hr) occurs, decrease furosemide dose by 50% and discuss with Medical staff.

If polyuria occurs with furosemide infusion administration in patients with acute kidney injury, it will continue until renal recovery – replace fluid as appropriate.

General Administration Information

- **Infusion preparation:**
  Infuse undiluted. Solutions with a yellow colour shouldn't be used.
  Discard any remaining solution after 24 hours.
- **Infusion pump:** Alaris® Syringe Module with Guardrails.
- **Routes of administration:**

IV injection (bolus, doses 80 mg or less):	Yes
IV intermittent infusion:	Yes
IV continuous infusion:	Yes
IM injection:	Yes, undiluted (not in this guideline)
Subcut injection:	Only in palliative care patients (not in this guideline)

- **Compatible/incompatible IV drugs/fluids:**
  Consult the Australian Injectable Drugs Handbook ('Yellow book') in your ward area. **Assume all unlisted drugs and IV fluids are incompatible – contact Pharmacy for further advice.**

MONITORING (INCLUDING BLOOD TESTS)

- All patients receiving IV furosemide must be weighed daily as part of a fluid balance management plan. Daily weight must be recorded on the Adult Daily Fluid Balance Chart (MR 620.0).
- The patient's dry or target weight (if known), must be recorded on Fluid Balance Summary (MR 615.1). Medical staff should clearly document a patient's dry/target weight in the progress notes.
- Baseline serum sodium, potassium, chloride, creatinine, calcium and magnesium. Repeat sodium, potassium, chloride and creatinine at least daily if practicable, particularly when diuresis is large. Repeat calcium and magnesium as clinically indicated.
- Hyponatraemia, hypokalaemia and hypovolaemia may occur during treatment.

NURSING PRACTICE POINTS

- ICU continuous infusion: Baseline blood pressure (BP), then every 30 minutes during infusion.
- Non-ICU continuous infusion: Baseline BP, then every 4 hours during infusion, unless MET or clinical review criteria are met, in which case contact medical staff for input.
- Monitor urine output and fluid balance.
- Observe for signs of excessive dehydration (tachycardia, hypotension, low jugular venous pressure (JVP), thirst, dry mucosa, drowsiness, oliguria, decreased skin turgor, cramps).
- Monitor for hearing loss in high risk patients: patients receiving large doses (greater than 120 mg per dose, including infusion doses), renal impairment, concomitant ototoxics, uraemic patients.
- ICU liaison nurse outreach can be called to assist if required.

ADVERSE EFFECTS:

Most adverse effects are dose-related.

- **Common** - hyponatraemia, hypokalaemia, hypomagnesaemia, hypochloraemia, hypocalcaemia, dehydration, hyperuricaemia, gout, metabolic alkalosis, increased creatinine concentration, dizziness, orthostatic hypotension and syncope.
- **Infrequent** - dyslipidaemia and rash.
- **Rare** - tinnitus, vertigo, deafness (especially with rapid IV administration), acute pancreatitis, jaundice, thrombocytopenia, haemolytic anaemia, agranulocytosis, interstitial nephritis, exfoliative dermatitis, Stevens-Johnson syndrome and bullous eruptions.

DRUG PRESENTATIONS AND STORAGE

Furosemide 20 mg/2 mL ampoules.
Furosemide 250 mg/25 mL ampoules.
Store below 25°C. Protect ampoules from light.

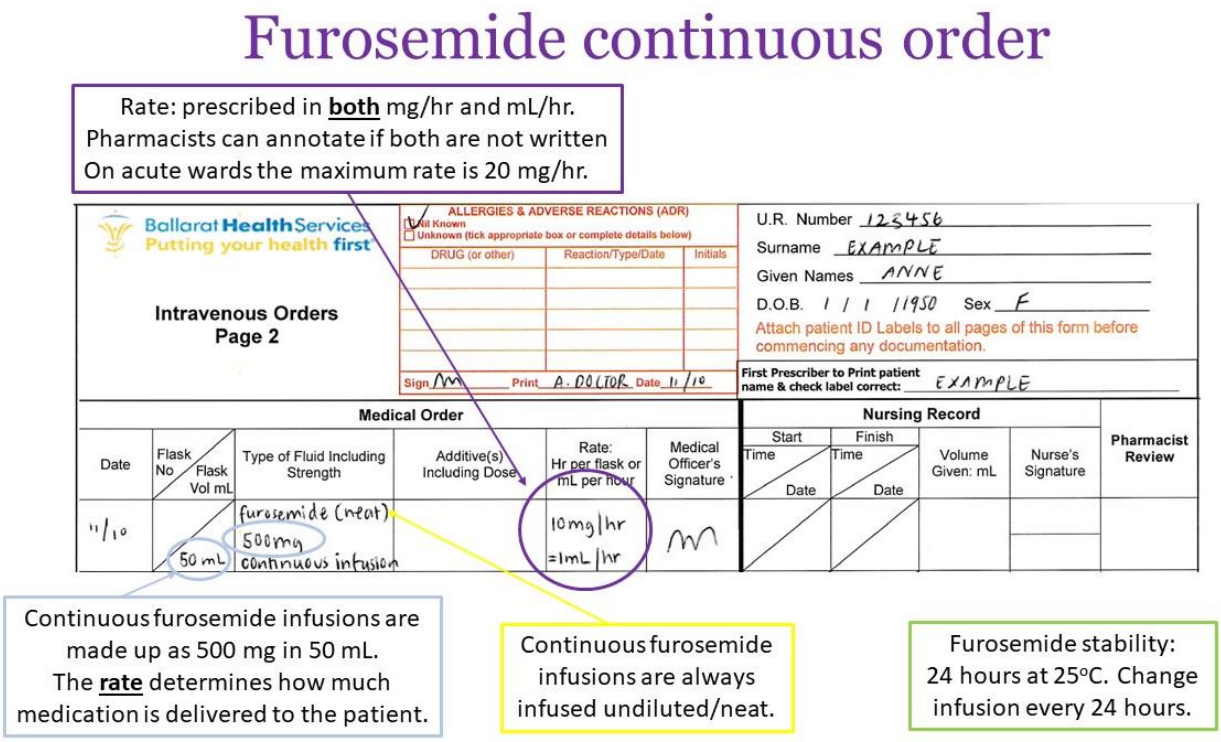
Appendix 1: Furosemide IV Continuous Infusion Prescribing Guide for General Adult Wards (excluding Subacute) and Coronary Care Unit

Prescribing guide:

- Chart on IV Orders Chart MR/645.0
- Furosemide continuous infusions are only to be prescribed and administered undiluted (neat) as furosemide 500 mg in 50 mL. The concentration is 10 mg/mL.
- **Dose and Rate:** to be prescribed in **BOTH** mg/hr **AND** mL/hr (see chart below).
- Continuous furosemide infusions are drawn up into a 50 mL luer lock syringe and run via Alaris® syringe module with Guardrails.
- The infusion continues until the Prescriber ceases the infusion. A new order and syringe are required (if the infusion is to continue) when 24 hours has elapsed, or if the syringe runs out, whichever is sooner.
- **To change the rate:** the current rate should be crossed out and the new rate written with time, date and signature. A new syringe is not required unless 24 hours has elapsed or the syringe has run out.

Furosemide IV Continuous Infusion Dose and Rate Chart			
Dose (mg/hr)	**Infusion rate (mL/hr)**	**Total volume (mL) over 24 hours**	**Total dose (mg) given over 24 hours**
5	0.5	12	120
10	1	24	240
15	1.5	36	360
20	2	48	480

Example Prescription:



Appendix 2: Furosemide IV Continuous Infusion Administration Procedure
Equipment:

1 x Alaris® System PCU
1 x Alaris® Syringe Module
1 x Drawing up needle
2 x Furosemide 250 mg/25 mL ampoules
1 x Extension set for syringe pump with Pressure Sensing Disc
1 x 50 mL luer lock syringe

Procedure:

1) Using two furosemide 250 mg/25 mL ampoules, draw up 50 mL furosemide undiluted into a 50 mL luer lock syringe, i.e. syringe contains 500 mg in 50 mL
2) Prime the line manually with furosemide solution (use extension set with pressure sensing disc as above). Gently massage the pressure sensing disc to ensure no air bubbles.
3) Place the syringe into the syringe module. The pump display indicates where to place the flange, barrel clamp and plunger gripper.
4) Slide pressure sensing disc into its slot until a click is heard.
5) Program Alaris® infusion pump:
   a) Channel select: Syringe Module (note: furosemide will only be visible if the syringe module is attached and selected).
   b) Profile: General Adult or Coronary Care Unit according to location of patient
   c) Guardrails drugs > FurosemideCONTINUOUS
   d) Drug set up is pre-programmed as 500 mg in 50 mL with dosing units in mg/hr, click NEXT to confirm.
   e) Enter dose (mg/hr) or rate (mL/hr) as prescribed on IV orders chart (pump will automatically calculate the other parameter, double check both are correct).
   f) VTBI: the pump automatically detects the volume remaining in the syringe. You cannot enter more than what is detected in the syringe. E.g. if pump says ‘available: 49.2 mL’ (as pictured above) VTBI must be 49.2 mL or less.
   g) Press START.
   h) Syringe must be changed every 24 hours.