BRIEF ADMINISTRATION GUIDE

(For more detailed guideline information please see the following pages)

Indications:

- Volume expansion[1-3]
- Hypotension[4]
- Daily maintenance[3,4]
- Hyponatraemia secondary to sodium deficiency[1,3,4]

Route: Intravenous or Oral[1,3,5,6]

Dose:

Volume Expansion, Hypotension

- **Sodium chloride 0.9%** 10 ml/kg IV over 20 to 30 minutes[1-4]
- Consider a second dose of 10 ml/kg if there is no significant improvement after the first dose[1-4]

Daily Maintenance

- Normal Daily Requirement 2 – 5 mmol/kg/day[1,3]
- Infants born ≤ 32 weeks gestation and those receiving diuretic therapy may require higher doses[1,3]
- May be administered orally in divided doses mixed with feeds or by intravenous infusion over 6 hours using **sodium chloride 0.9%**[1,3]

Hyponatraemia

- Dose determined by sodium deficit, to calculate[1,3]:
  Dose (mmol) = (135 – serum sodium (mmol/L)) x 0.6 x weight (kg)
- Administer by intravenous infusion over 6 hours for acute hyponatraemia or 12 - 24 hours for severe or prolonged hyponatraemia using **sodium chloride 0.9% or hypertonic sodium chloride**[1,3]

Supplied as:

- Sodium chloride 0.9% (0.15 mmol/ml), 10 ml, 500 ml[5]
- Sodium chloride 23.4% (4 mmol/ml) injection, 20 ml[7]
- Sodium chloride 2 mmol/ml oral liquid, 25 ml[6]

Preparation and administration:

Intravenous Infusion

- Sodium chloride 23.4% (4 mmol/ml) is a hypertonic solution and must be diluted prior to IV infusion. Water for injection and glucose 5% or 10% are the preferred diluents[8]
- Hypertonic solutions are preferably administered by a large central vein. If administered peripherally, a large arm vein should be used, and if possible change the injection site daily[1,4]
- Administer sodium chloride 0.9% or hypertonic sodium chloride as prescribed by intravenous infusion

Oral

- Oral sodium chloride must be diluted with breast milk or formula feeds[3,6]
- Ensure the solution is thoroughly mixed into the feeds immediately prior administration

Monitoring:

- Monitor blood pressure, heart rate, respiratory rate and oxygen saturations periodically during treatment[2,3]
- Monitor serum sodium concentrations at baseline and every 6 hours during therapy[1,3]
- Monitor renal function, electrolytes and fluid balance[1,9]
- IV: Monitor injection site for irritation, pain, phlebitis[8,9]
- Oral: Monitor for signs of gastric irritation[8]

1. Purpose and scope

To facilitate the safe and effective use of sodium chloride in the Neonatal Intensive Care Unit (NICU).

Note: Hypertonic Sodium chloride (concentration greater than 0.9%) is considered a high alert medication which has an increased risk of causing significant patient harm if it is used in error[1,4].

2. Drug

Drug	Sodium chloride
Drug action	Sodium is the principle cation of extracellular fluid and chloride is the principle anion of the extracellular fluid. The main functions are water distribution, fluid and electrolyte balance, and osmotic pressure in the extracellular fluid[1,3,10].
Indications	• Volume expansion[1-3] • Hypotension[4] • Daily maintenance[3,4] • Hyponatraemia secondary to sodium deficiency[1,3,4]
Presentation	• Sodium chloride 0.9% (0.15 mmol/ml), 10 ml, 500 ml[5] • Sodium chloride 23.4% (4 mmol/ml) injection, 20 ml[7] • Sodium chloride 2 mmol/ml oral liquid, 25 ml[6]
Route	Intravenous or Oral[1,3,5,6]
Dose	**Volume Expansion, Hypotension** • **Sodium chloride 0.9%** 10 ml/kg IV over 20 to 30 minutes[1-4] • Consider a second dose of 10 ml/kg if there is no significant improvement after the first dose[1-4] **Daily Maintenance** • Normal Daily Requirement 2 – 5 mmol/kg/day[1,3] • Infants born ≤ 32 weeks gestation and those receiving diuretic therapy may require higher doses[1,3] • May be administered orally or by intravenous infusion over 6 hours using **sodium chloride 0.9%[1,3]** • Oral sodium chloride should be administered in divided doses mixed with feeds (aim for practical volumes)[3,8]. Dose should not exceed 2 mmol/100 ml of formula feed, or 4 mmol/100 ml of breast milk[6] **Hyponatraemia** • Dose determined by sodium deficit, to calculate[1,3]: Dose (mmol) = (135 – serum sodium (mmol/L)) x 0.6 x weight (kg) • Administer by intravenous infusion using **sodium chloride 0.9% or hypertonic sodium chloride**[1,3] • Acute hyponatraemia may be corrected over 6 hours. Severe hyponatremia (serum sodium < 120 mmol/L) or prolonged hyponatraemia (> 24 hours) should be corrected over 12 – 24 hours. • In neonates the rise in plasma sodium concentration should generally not exceed 10 mmol/L in 24 hours[1,4,5]

	Example calculation[3]: • 2 kg baby, serum sodium 130 mmol/L • Sodium dose (mmol) = (135 – 130) x 0.6 x 2 = 6 mmol • Take 6 mmol sodium (1.5 ml of 4 mmol/ml sodium chloride) and make up to 12 ml with water for injection and infuse at 0.5 ml/h for 24 hours Infusion concentration is 6 mmol/12 ml = 0.5 mmol/ml
Contraindications	• Hypersensitivity to sodium chloride, or any component of the preparation[1,3] • Hypernatraemia (except when used for increased intracranial pressure[1]
Precautions	• Renal impairment[1,5,10] • Cardiac failure, hypertension[1,5,10] • Peripheral and pulmonary oedema[1,5,10] • Concurrent use of corticosteroids because of potential sodium and fluid retention[10] • Rapid administration can result in cerebral oedema, herniation, seizures, coma and death[1,2,4] • Large fluid volumes can decrease cardiac output in hypoxic infants[2]
Incompatibilities	• Compatible with many drugs and solutions. Refer to individual drugs for compatibilities or consult a pharmacist[3]
Adverse effects	• Oedema, hypervolemia, pulmonary oedema[1,3,5,10] • Congestive heart failure, transient hypotension[1] • Dilution of serum electrolytes, hypernatremia, hypokalaemia, hypochloraemia metabolic acidosis[1,5,10] • Central pontine myelinolysis (due to rapid correction of hyponatraemia[1] • Injection site reactions, phlebitis, extravasation[1,10] • Hypersensitivity/infusion reactions including hypotension, pyrexia, tremor, chills, urticarial, rash and pruritus[10] • Oral: Nausea, vomiting[1,3]

3. Administration

Competency for administration	This procedure is carried out by, or under, the direct supervision of a registered nurse/registered midwife who holds current Waikato DHB Generic Medicine Management and IV certification as well as Neonatal specific competency NCV/NAC.
Preparation & Administration	**Intravenous Infusion** • Sodium chloride 23.4% (4 mmol/ml) is a hypertonic solution and must be diluted prior to IV infusion. Water for injection and glucose 5% or 10% are the preferred diluents[8] • Hypertonic solutions (greater than 0.9%) are preferably administered by a large central vein. If hypertonic solutions are administered peripherally, a large arm vein should be used, and if possible the injection site should be changed daily[1,4] • Administer sodium chloride 0.9% or hypertonic sodium chloride as prescribed by intravenous infusion • Any remaining solution should be discarded

	Oral • The oral solution must be diluted with breast milk or formula feeds[3,6] • Ensure the solution is thoroughly mixed into the feeds immediately prior administration
Observations and management	• Monitor blood pressure, heart rate, respiratory rate and oxygen saturations periodically during treatment[2,3] • Monitor serum sodium concentrations at baseline and every 6 hours during therapy[1,3] • Monitor renal function, electrolytes and fluid balance[1,9] • IV: Monitor injection site for irritation, pain, phlebitis[8.9] • Oral: Monitor for signs of gastric irritation[8] • Assess for signs of anaphylaxis or adverse reactions
Special considerations (audit, funding, storage)	• Sodium chloride has a pH of 4 to 7[10] • Ampoules, premixed bags should be stored at room temperature[10] • Oral solution should be stored at room temperature. Once opened, must be refrigerated between 2 to 8 °C and discarded after 7 days[3]
Rescue medication	Discontinue immediately and seek urgent medical assistance if anaphylaxis or severe adverse reactions occur. Administer adrenaline and maintain airway as appropriate.

4. Guardrails

Sodium chloride is Guardrail profiled on the CC and GP pumps for NICU. **Note these apply to sodium chloride 0.9% only.** Following are the guardrail limits[11]:

Guardrails Drug Name Pump Dose rate	Sodium Chloride CC & GP	Sodium Chlor BOLUS CC & GP
Default	3.5 ml/hr	30 ml/kg/hr
Soft minimum	1 ml/hr	28 ml/kg/hr
Soft maximum	30 ml/hr	60 ml/kg/hr
Hard max	50 ml/hr	61 ml/kg/hr

5. References

1. American Pharmacists Association. Pediatric & Neonatal Dosage Handbook. 20th edition. 2013.
2. Truven Health Analytics Inc. Pediatrics and Neofax®. 2018. Sodium chloride 0.9% monograph. Accessed 8th May 2018. Available from: http://www.micromedexsolutions.com.
3. Christchurch DHB Neonatal Services. Sodium Chloride Drug Information Sheet. March 2016. Available from: http://www.cdhb.health.nz/Hospitals-Services/Health-Professionals/Neonatal-Clinical-Resources/Neonatal-Drug-Information-Sheets.
4. Phelps SJ, Hagemann TM, Lee KR, Thompson AJ. The Teddy Bear Book: Pediatric Injectable Drugs. 10th edition. Amphotericin B Liposomal. American Society of Health-System Pharmacists; 2013.
5. New Zealand Formulary for Children (NZFC). 2018. Sodium Chloride (Intravenous). Accessed 8th May 2018. Available from: http://www.nzfchildren.org.nz/nzf_5046.
6. New Zealand Formulary for Children (NZFC). 2018. Sodium Chloride (oral). Accessed 8th May 2018. Available from: http://www.nzfchildren.org.nz/nzf_5028.
7. New Zealand Formulary for Children (NZFC). 2018. Sodium Chloride Oral Liquid. Accessed 8th May 2018. Available from: https://www.nzfchildren.org.nz/nzf_15423.
8. Royal Prince Alfred Hospital Newborn Care. Sodium chloride 23.4% Drug Information Sheet. September 2017. Available from: https://www.slhd.nsw.gov.au/rpa/neonatal/NeoMedPaperCopy.html
9. New Zealand Hospital Pharmacists Assoc. Inc. Notes on Injectable Drugs 7th ed, 2015.

10. Baxter Healthcare Ltd. Sodium Chloride 0.45%, 0.9%, 3% Infusion, solution. 18 August 2014. Available from: http://www.medsafe.govt.nz/profs/datasheet/s/SodiumChlorideViaFlex.pdf.

11. Waikato DHB. Guardrails Database. 2018.