		Type: <b>Drug Guideline</b>	Document reference: <b>0594</b>	Manual Classification: <b>Waikato DHB Drug Guidelines</b>
Title: <b>Calcium Chloride for neonates</b>			Effective date: <b>30 September 2018</b>	
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## BRIEF ADMINISTRATION GUIDE

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

### Indications:

- Hypocalcaemia (corrected calcium < 1.7 mmol/L)<sup>1-5</sup>
- Acute hyperkalaemia with secondary cardiac toxicity<sup>2-5</sup>

### Route:

- Intravenous<sup>1-4</sup>
- Umbilical venous catheter (UVC), if centrally placed

### Dose:

*Doses are expressed in mmol of elemental calcium.*

#### Acute Hypocalcaemia, Urgent Correction<sup>1,3</sup>

0.2 – 0.48 mmol/kg (0.3 - 0.7 ml/kg calcium chloride 10%) as a single dose by slow IV injection. May be repeated as required.

#### Acute Hypocalcaemia, Maintenance<sup>1,3,4</sup>

1 mmol/kg/day (1.5 ml/kg/day calcium chloride 10%) administered in 4 divided doses by IV infusion, adjusted according to response.

#### Acute hyperkalaemia<sup>3-6</sup>

0.14 mmol/kg (0.2 ml/kg calcium chloride 10%) as a single dose by slow IV injection.

### Supplied as:

Calcium chloride 10% (0.68 mmol/ml elemental calcium), 10 ml vial<sup>1</sup>

### Preparation and administration:

- Prepare immediately before use and visually inspected for discolouration, cloudiness or precipitation; do not use if present.
- Administer via a central line if available, or via a small needle into a large vein if giving peripherally.
- Do NOT administer via scalp vein, or small hand or foot vein.
- Discard any unused portion of the original vial remaining.

#### Direct IV Injection<sup>2,4,7</sup>


- Administer prescribed dose undiluted by slow IV injection over 3 to 5 minutes.
- During cardiac arrest, may be administered over 10 – 20 seconds.

#### Intermittent IV Infusion<sup>6,7</sup>

- Draw up 1.5 ml (1.02 mmol elemental calcium) and add 8.5 ml sodium chloride 0.9% or glucose 5% to make 10 ml of a 0.1 mmol/ml solution.
- Administer prescribed dose by intravenous infusion over at least 60 minutes.

### Monitoring:

- Ensure continuous ECG, blood pressure and heart rate monitoring during therapy<sup>2,4,7,8</sup>.
- Ensure proper catheter or needle placement to avoid extravasation<sup>8</sup>
- Monitor IV site continuously during treatment for site reactions or signs of extravasation<sup>2,3,7,8</sup>. If extravasation occurs, stop administration immediately and refer to the Extravasation Injury in NICU Procedure 1559.
- Monitor for adverse effects associated with rapid administration including vasodilation hypotension, bradycardia, arrhythmias and cardiac arrest<sup>2,3,7</sup>.
- Monitor serum calcium at frequent intervals to guide therapy and ensure normal serum calcium levels are not exceeded<sup>2-4,8</sup>
- Monitor magnesium and phosphate as clinically indicated<sup>4</sup>

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## 1. Purpose and scope

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

Note: Parenteral calcium is available in two forms in New Zealand, calcium gluconate and calcium chloride. These are not interchangeable and have a threefold difference in the elemental calcium concentration between formulations. Medication errors have occurred with incorrect selection of calcium products and have resulted in patient harm. **Please ensure the prescriber has specified the salt form, that you are using the correct guideline and that the correct product has been selected<sup>4,5</sup>.**

## 2. Drug


<b>Drug</b>	Calcium chloride
<b>Drug action</b>	Calcium is essential for the functional integrity of the nervous, muscular, and skeletal systems and cell membrane and capillary permeability. As an activator of many enzyme reactions, calcium is essential in transmission of nerve impulses; contraction of cardiac, smooth, and skeletal muscles; respiration; blood coagulation; and renal function <sup>2,6</sup> . It also antagonises the cardiotoxic effects (arrhythmias) of hyperkalaemia and hypermagnesaemia <sup>6,9</sup> .
<b>Indications</b>	<ul style="list-style-type: none"> <li>Hypocalcaemia (corrected calcium &lt; 1.7 mmol/L)<sup>1-5</sup> <ul style="list-style-type: none"> <li>Urgent correction of acute hypocalcaemia</li> <li>Maintenance of acute hypocalcaemia</li> </ul> </li> <li>Acute hyperkalaemia with secondary cardiac toxicity<sup>2-5</sup></li> </ul>
<b>Presentation</b>	Calcium chloride 10% (0.68 mmol/ml elemental calcium), 10 ml vial <sup>1</sup> . Clear, colourless solution. Excipients include water for injection <sup>8</sup> .
<b>Route</b>	Intravenous <sup>1-4</sup> or via Umbilical venous catheter (UVC), if centrally placed Avoid intra-arterial and subcutaneous administration. Must NOT be given intramuscularly. For oral administration, refer to Calcium Oral for neonates Drug Guideline 2903.
<b>Dose</b>	<p><i>Doses are expressed in mmol of elemental calcium.</i></p> <p><b>Acute Hypocalcaemia, Urgent Correction<sup>1,3</sup></b></p> <ul style="list-style-type: none"> <li>0.2 – 0.48 mmol/kg (0.3 - 0.7 ml/kg calcium chloride 10%) as a single dose.</li> <li>Administer by slow IV injection.</li> <li>May be repeated as required.</li> </ul> <p><b>Acute Hypocalcaemia, Maintenance<sup>1,3,4,6</sup></b></p> <ul style="list-style-type: none"> <li>1 mmol/kg/day (1.5 ml/kg/day calcium chloride 10%), adjusted according to response.</li> <li>Administer in 4 divided doses by IV infusion.</li> </ul> <p><b>Acute hyperkalaemia<sup>3-6</sup></b></p> <ul style="list-style-type: none"> <li>0.14 mmol/kg (0.2 ml/kg calcium chloride 10%) as a single dose.</li> <li>Administer by slow IV injection.</li> </ul>
<b>Contraindications</b>	<ul style="list-style-type: none"> <li>Hypercalcaemia<sup>1,2,4</sup></li> <li>Hypercalciuria<sup>1,2</sup></li> <li>Severe renal impairment<sup>2</sup></li> <li>Ventricular fibrillation<sup>2,3</sup></li> </ul>

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<b>Precautions</b>	<ul style="list-style-type: none"> <li>• Renal impairment<sup>1,4,6</sup></li> <li>• Cardiac impairment<sup>2,6</sup></li> <li>• Sarcoidosis<sup>1,2</sup></li> <li>• history of nephrolithiasis<sup>1,2</sup></li> <li>• Electrolyte disturbances including hypokalaemia, hypomagnesemia, hyperphosphatemia<sup>4</sup></li> <li>• Extravasation risk as parenteral calcium is a vesicant causing profound tissue necrosis<sup>2,4</sup></li> <li>• Respiratory acidosis or respiratory failure<sup>1,2,4</sup></li> </ul>
<b>Incompatibilities</b>	<ul style="list-style-type: none"> <li>• Compatible with glucose 5%, sodium chloride 0.9% for IV infusion<sup>7,8</sup> and water for injection, sodium chloride 0.9% for direct IV injection<sup>8</sup></li> <li>• Ensure calcium is administered at a different time to phosphates, carbonates, sulfates or tartrates (precipitates can occur)<sup>2,5,6,9</sup></li> <li>• Should not be administered with parenteral nutrition due to risk of precipitation with phosphate component<sup>2,5</sup></li> <li>• Neonates receiving ceftriaxone or digoxin should not be given calcium containing fluids<sup>2-5</sup></li> </ul>
<b>Adverse effects</b>	<ul style="list-style-type: none"> <li>• Rapid administration is associated with vasodilation, hypotension, bradycardia, syncope, cardiac arrhythmias, and cardiac arrest<sup>1,2,4,7</sup></li> <li>• Injection site reactions<sup>1,2</sup></li> <li>• Severe tissue damage with extravasation including tissue sloughing and necrosis<sup>1,2,4</sup></li> <li>• Chalky taste, hot flashes<sup>2,4</sup></li> <li>• Nephrolithiasis<sup>4</sup></li> </ul>

### 3. Administration


<b>Competency for administration</b>	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.
<b>Preparation &amp; Administration</b>	<p><b>IV Injection</b><sup>2,4,7</sup></p> <ul style="list-style-type: none"> <li>• Prepare immediately before use and visually inspected for discolouration, cloudiness or precipitation; do not use if present.</li> <li>• Administer prescribed dose undiluted by slow IV injection over 3 to 5 minutes via a central line if available, or via a small needle into a large vein if giving peripherally.</li> <li>• During cardiac arrest, may be administered over 10 to 20 seconds.</li> <li>• Do NOT administer via scalp vein, or small hand or foot vein.</li> <li>• Discard any unused portion of the original vial remaining.</li> </ul> <p><b>IV Infusion</b><sup>6,7</sup></p> <ul style="list-style-type: none"> <li>• Prepare immediately before use and visually inspected for discolouration, cloudiness or precipitation; do not use if present.</li> <li>• Draw up 1.5 ml (1.02 mmol elemental calcium) and add 8.5 ml sodium chloride 0.9% or glucose 5% to make 10 ml of a 0.1 mmol/ml solution.</li> <li>• Administer prescribed dose by intravenous infusion over at least 60 minutes via a central line if available, or via a small needle into a large vein if giving peripherally.</li> <li>• Do NOT administer via scalp vein, or small hand or foot vein.</li> <li>• Discard any unused portion of the original vial remaining.</li> </ul>

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<b>Observations and management</b>	<ul style="list-style-type: none"> <li>• Ensure continuous ECG, blood pressure and heart rate monitoring during therapy<sup>2,4,7,8</sup>.</li> <li>• Ensure proper catheter or needle placement to avoid extravasation<sup>8</sup></li> <li>• Monitor IV site continuously during treatment for site reactions or signs of extravasation<sup>2,3,7,8</sup>. If extravasation occurs, stop administration immediately and refer to the Extravasation Injury in NICU Procedure 1559.</li> <li>• Monitor for adverse effects associated with rapid administration including vasodilation hypotension, bradycardia, arrhythmias and cardiac arrest<sup>2,3,7</sup>.</li> <li>• Monitor serum calcium at frequent intervals to guide therapy and ensure normal serum calcium levels are not exceeded<sup>2-4,8</sup></li> <li>• Monitor magnesium and phosphate as clinically indicated<sup>4</sup></li> </ul>
<b>Special considerations (audit, funding, storage)</b>	<ul style="list-style-type: none"> <li>• Calcium chloride has a pH of 5 to 8<sup>8</sup></li> <li>• Vials should be stored at room temperature (below 25°C)<sup>8</sup></li> <li>• Diluted solution should be prepared immediately before use, however, is stable at room temperature for up to 24 hours<sup>8</sup>.</li> <li>• To calculate corrected calcium: <ol style="list-style-type: none"> <li>1. Measure serum albumin</li> <li>2. For every g/L albumin is less than 40, add 0.02 mmol/L to total calcium, e.g. albumin 30, total calcium 1.6 mmol <ol style="list-style-type: none"> <li>(a) <math>40 - 30 = 10</math></li> <li>(b) <math>10 \times 0.02 = 0.2</math></li> <li>(c) <math>1.6 + 0.2 = 1.8 \text{ mmol/L}</math></li> </ol> </li> </ol> </li> </ul>
<b>Rescue medication</b>	<p><b>For management of calcium gluconate overdose or hypercalcaemia, consider the following measures<sup>2</sup>:</b></p> <ul style="list-style-type: none"> <li>• Immediately discontinue administration of calcium gluconate and other calcium-containing medications.</li> <li>• Hydration with intravenous sodium chloride 0.9% and forced diuresis with frusemide to rapidly increase calcium excretion.</li> <li>• Monitor potassium and magnesium serum concentrations and correct as required.</li> <li>• Monitor cardiac function and possibly use beta-adrenergic blocking agents to protect the heart against serious arrhythmias.</li> <li>• Monitor serum calcium concentrations at frequent intervals to guide therapy adjustments.</li> </ul> <p><b>For the management of extravasation<sup>4</sup>:</b></p> <ul style="list-style-type: none"> <li>• Stop administration immediately and disconnect (leave needle/cannula in place)</li> <li>• Gently aspirate extravasated solution (do NOT flush the line)</li> <li>• Consider use of hyaluronidase antidote for treatment of extravasation injuries.</li> <li>• Apply dry cold compresses and elevate extremity.</li> <li>• Refer to the Extravasation Injury in NICU Procedure 1559.</li> </ul>

#### 4. Associated documents

- Waikato DHB. Calcium Gluconate for neonates Drug Guideline. Document 0596.
- Waikato DHB. Calcium Oral for neonates Drug Guideline. Document 2903.
- Waikato DHB. Extravasation Injury in NICU Procedure. Document 1559.

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## 5. References

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