		Type: Drug Guideline	Document reference: 0596	Manual Classification: Waikato DHB Drug Guidelines
Title: Calcium Gluconate for neonates			Effective date: 30 September 2018	
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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)¹⁻⁸
- Acute hyperkalaemia with secondary cardiac toxicity^{2,4,5,7,8}

Route:

- Intravenous¹⁻⁴
- Umbilical venous catheter (UVC), if centrally placed³

Dose:

Doses are expressed in mmol of elemental calcium

Acute Hypocalcaemia, Urgent Correction^{1,2,4,6,9}

0.22 – 0.44 mmol/kg (1 - 2 ml/kg calcium gluconate 10%) as a single dose by slow IV injection. May be repeated as required.

Acute Hypocalcaemia, Maintenance^{1,6,9}

1 mmol/kg/day (4.5 ml/kg/day calcium gluconate 10%), administered in 4 divided doses by IV infusion adjusted according to response.

Acute hyperkalaemia^{1,7}

0.11 mmol/kg (0.5 ml/kg calcium gluconate 10%) as a single dose by slow IV injection.

Supplied as:

Calcium gluconate 10% (calcium 0.22 mmol/ml), 10 ml ampoule¹

Preparation and administration:

- Prepare immediately before use.
- Calcium gluconate 10% is a supersaturated solution prone to precipitation. Visually inspect 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 ampoule remaining.

Direct IV Injection^{2,10,11}


- 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^{10,11}

- Draw up 5 ml (1.1 mmol elemental calcium) and add 5 ml of compatible fluid to make 10 ml of a 0.11 mmol/ml solution.
- Administer prescribed dose by intravenous infusion over 10 - 60 minutes.

Monitoring:

- Ensure continuous ECG, blood pressure and heart rate monitoring during therapy^{4,7,8,11}.
- Ensure proper catheter or needle placement to avoid extravasation¹¹.
- Monitor IV site continuously during treatment for site reactions or signs of extravasation^{8,7,11}. If extravasation occurs, stop administration immediately and refer to the Extravasation Injury in NICU Procedure 1559.
- Observe IV tubing for precipitates^{7,8}.
- Monitor for adverse effects associated with rapid administration including vasodilation hypotension, bradycardia, arrhythmias and cardiac arrest^{2,3,10}.
- Monitor serum calcium at frequent intervals to guide therapy and ensure normal serum calcium levels are not exceeded^{4,7,11}.
- Monitor magnesium and phosphate as clinically indicated⁴.

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1. Purpose and scope

To facilitate the safe and effective use of calcium gluconate 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^{4,5}.**

2. Drug

Drug	Calcium gluconate
Drug action	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 ^{2,6,8} . It also antagonises the cardiotoxic effects (arrhythmias) of hyperkalaemia and hypermagnesaemia ^{8,9} .
Indications	<ul style="list-style-type: none"> • Hypocalcaemia (corrected calcium < 1.7 mmol/L)¹⁻⁸ <ul style="list-style-type: none"> ▪ Urgent correction of acute hypocalcaemia ▪ Maintenance of acute hypocalcaemia • Acute hyperkalaemia with secondary cardiac toxicity^{2,4,5,7,8}
Presentation	Calcium gluconate 10% (calcium 0.22 mmol/ml), 10 ml ampoule ¹ Clear colourless solution. Excipients include calcium saccharate, water for injection ^{2,11}
Route	Intravenous ¹⁻⁴ or via Umbilical venous catheter (UVC), if centrally placed ³ . Avoid intra-arterial and subcutaneous administration. Must NOT be given intramuscularly. For oral administration, refer to Calcium Oral for neonates Drug Guideline 2903.
Dose	<p><i>Doses are expressed in mmol of elemental calcium.</i></p> <p>Acute Hypocalcaemia, Urgent Correction^{1,2,4,6,9}</p> <ul style="list-style-type: none"> • 0.22 – 0.44 mmol/kg (1 - 2 ml/kg calcium gluconate 10%) as a single dose. • Administer by slow IV injection. • May be repeated as required. <p>Acute Hypocalcaemia, Maintenance^{1,6,9}</p> <ul style="list-style-type: none"> • 1 mmol/kg/day (4.5 ml/kg/day calcium gluconate 10%), adjusted according to response. • Administer in 4 divided doses by IV infusion. <p>Acute hyperkalaemia^{1,7}</p> <ul style="list-style-type: none"> • 0.11 mmol/kg (0.5 ml/kg calcium gluconate 10%) as a single dose. • Administer by slow IV injection.

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Contraindications	<ul style="list-style-type: none"> • Hypercalcaemia¹⁻⁴ • Hypercalciuria^{1,2} • Severe renal impairment² • Ventricular fibrillation³
Precautions	<ul style="list-style-type: none"> • Renal impairment^{1,3,4} • Cardiac impairment^{3,6-8} • Sarcoidosis¹ • History of nephrolithiasis^{1,4} • Electrolyte disturbances including hypokalaemia, hypomagnesemia, hyperphosphatemia^{4,6} • Extravasation risk as parenteral calcium is a vesicant causing profound tissue necrosis^{2,4}
Incompatibilities	<ul style="list-style-type: none"> • Compatible with glucose 5%, sodium chloride 0.9%, Lactated Ringers (Hartmann's)^{10,11} • Ensure calcium is administered at a different time to phosphates, carbonates, sulfates or tartrates (precipitates can occur)^{5,8,9} • Should not be administered with parenteral nutrition due to risk of precipitation with phosphate component⁵ • Neonates receiving ceftriaxone or digoxin should not be given calcium containing fluids²⁻⁵
Adverse effects	<ul style="list-style-type: none"> • Rapid administration is associated with vasodilation, hypotension, bradycardia, syncope, cardiac arrhythmias, and cardiac arrest¹⁻⁴ • Injection site reactions^{1,2} • Severe tissue damage with extravasation including tissue sloughing and necrosis^{1,2,4,5} • Chalky taste⁴

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	<p>Direct IV Injection^{2,10,11}</p> <ul style="list-style-type: none"> • Prepare immediately before use. • Calcium gluconate 10% is a supersaturated solution prone to precipitation. Visually inspect for discolouration, cloudiness or precipitation; do not use if present. • 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. • During cardiac arrest, may be administered over 10 to 20 seconds. • Do NOT administer via scalp vein, or small hand or foot vein. • Discard any unused portion of the original ampoule remaining. <p>Intermittent IV Infusion^{10,11}</p> <ul style="list-style-type: none"> • Prepare immediately before use. • Calcium gluconate 10% is a supersaturated solution prone to precipitation. Visually inspect for discolouration, cloudiness or precipitation; do not use if present.

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	<ul style="list-style-type: none"> • Draw up 5 ml (1.1 mmol elemental calcium) and add 5 ml of compatible fluid to make 10 ml of a 0.11 mmol/ml solution. • Administer prescribed dose by intravenous infusion over 10 - 60 minutes 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 ampoule remaining.
Observations and management	<ul style="list-style-type: none"> • Ensure continuous ECG, blood pressure and heart rate monitoring during therapy^{4,7,8,11}. • Ensure proper catheter or needle placement to avoid extravasation¹¹. • Monitor IV site continuously during treatment for site reactions or signs of extravasation^{8,7,11}. If extravasation occurs, stop administration immediately and refer to the Extravasation Injury in NICU Procedure 1559. • Observe IV tubing for precipitates^{7,8}. • Monitor for adverse effects associated with rapid administration including vasodilation hypotension, bradycardia, arrhythmias and cardiac arrest^{2,3,10}. • Monitor serum calcium at frequent intervals to guide therapy and ensure normal serum calcium levels are not exceeded^{4,7,11}. • Monitor magnesium and phosphate as clinically indicated⁴.
Special considerations (audit, funding, storage)	<ul style="list-style-type: none"> • Calcium gluconate has a pH of 6 to 8.2¹¹. • Ampoules should be stored at room temperature (below 30°C). Do not refrigerate¹¹. • Diluted solution should be prepared immediately before use, however, is stable at room temperature for up to 24 hours^{2,11}. • Early hypocalcaemia is common in asphyxiated, preterm babies and infants of diabetic mothers. Treatment of asymptomatic hypocalcaemia is controversial^{6,7}.
Rescue medication	<p>For management of calcium gluconate overdose or hypercalcaemia, consider the following measures²:</p> <ul style="list-style-type: none"> • Immediately discontinue administration of calcium gluconate and other calcium-containing medications. • Hydration with intravenous sodium chloride 0.9% and forced diuresis with frusemide to rapidly increase calcium excretion. • Monitor potassium and magnesium serum concentrations and correct as required. • Monitor cardiac function and possibly use beta-adrenergic blocking agents to protect the heart against serious arrhythmias. • Possible treatment with calcitonin. • Monitor serum calcium concentrations at frequent intervals to guide therapy adjustments. <p>For the management of extravasation⁴:</p> <ul style="list-style-type: none"> • Stop administration immediately and disconnect (leave needle/cannula in place) • Gently aspirate extravasated solution (do NOT flush the line) • Consider use of hyaluronidase antidote for treatment of extravasation injuries. • Apply dry cold compresses and elevate extremity. • Refer to the Extravasation Injury in NICU Procedure 1559.

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4. Associated documents

- Waikato DHB. Calcium Chloride for neonates Drug Guideline. Document 0594.
- Waikato DHB. Calcium oral for neonates Drug Guideline. Document 2903.
- Waikato DHB. Extravasation Injury in NICU Procedure. Document 1559.

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