CALCIUM GLUCONATE

SCOPE (Area): FOR USE IN: Critical Care Unit, ED, Theatre, General Wards
EXCLUSIONS: Paediatrics (seek Paediatrician advice)
SCOPE (Staff): Medical, Nursing and Pharmacy

BRAND NAMES
No brand names.

PHARMACOLOGY AND PHARMACOKINETICS
Calcium is essential to maintain the integrity of the nervous, muscular and skeletal systems. It is involved in many physiological functions such as membrane stability, the clotting cascade, muscle contraction and neurotransmitter release in the central and peripheral nervous system. Calcium also has positive inotropic effects on cardiac muscle. Following IV administration, calcium levels rise immediately, with effects lasting 30 minutes to 2 hours once dosing has finished.

INDICATIONS
- Hypocalcaemia (including post thyroidectomy) and hypocalcaemic tetany.
- Adjunct in treatment of severe hyperkalaemia not due to digoxin toxicity.
- Adjunct in treatment of severe hypermagnesaemia.
- Drug-induced QT prolongation and torsades de pointes with co-existing hypocalcaemia
- Treatment of calcium channel blocker (verapamil and diltiazem) overdose.
- Treatment of magnesium toxicity in pre-eclampsia or eclampsia treated with IV magnesium. See Magnesium Sulfate (Obstetric) Drug Guideline DRG0036.
- Prevention of neuropathy with oxaliplatin administration – seek advice from Oncology or Oncology Pharmacist.
- Hydrofluoric acid burns – see Hydrofluoric Acid Burns Clinical Practice Protocol (CPP0493).

CONTRAINDICATIONS
- Digoxin toxicity – calcium is contraindicated as increased risk of arrhythmia.
- IM or subcut injection – can cause tissue necrosis and sloughing. Calcium gluconate is for intravenous administration only.
- Hypercalcaemia.

PRECAUTIONS
- Patients treated with digoxin – can lead to arrhythmias. See Contraindications also.
- Rapid IV injection - may cause severe venous irritation, vasodilatation, hot flushes, hypotension, bradycardia, cardiac arrhythmias, syncope and cardiac arrest.
- Extravasation - will cause tissue necrosis. Administer slowly via CVC or a large peripheral vein. Sites such as the back of the hand (or the forearm veins in chronic kidney disease or end stage renal failure patients) are not to be used except in emergency management until alternative IV access is obtained.
- Acute severe hyperphosphataemia – requires treatment (when treating hypocalcaemia) before IV calcium is administered.
- Hypercalciuria - e.g. hyperparathyroidism, vitamin D overdosage, decalcifying tumours such as plasmocytoma, bone metastases.
- Chronic hypocalcaemia – IV therapy may not be warranted (often associated with renal failure).
- Renal calculi – patients with a history (past or current) of renal calculi require increased fluid intake and monitoring of urine calcium excretion.
- Excessive dosing - large doses can lead to hypercalcaemia which is more dangerous than hypocalcaemia. Renal failure, dehydration, other electrolyte imbalances, sarcoidosis or other granulomatous disorders (can elevate vitamin D) increase the risk.

PREGNANCY AND BREASTFEEDING
Seek specialist advice before prescribing, information may update regularly.

DRUG INTERACTIONS
- Digoxin – see Contraindications and Precautions.
- Ceftriaxone – avoid where possible, do not administer simultaneously with IV calcium (even through a different line). Where unavoidable, flush before and after ceftriaxone administration with a compatible infusion fluid.
- Calcium channel blockers - calcium can reduce the effectiveness of verapamil and possibly other calcium channel blockers.
- Thiazide diuretics – decrease urinary calcium excretion, increases risk of hypercalcaemia.
- Phosphate - may increase risk of deposition of calcium in soft tissues.
- Vitamin A – excessive doses can lead to increased bone turnover and hypercalcaemia.

DOSAGE AND ADMINISTRATION
Administer slowly via CVC or a large peripheral vein. Sites such as the back of the hand are not to be used except in emergency management until alternative IV access is obtained.

Review Contraindications and Precautions prior to prescribing or administering.

Note: Calcium gluconate generally causes less venous irritation than calcium chloride, but requires three times the volume of calcium chloride for the same amount of calcium.

Acute hypocalcaemia (including post thyroidectomy) and hypocalcaemic tetany
Coexisting hypomagnesaemia should be treated before calcium (oral or IV) is given, or as soon as practicable after calcium commencement as it may cause treatment resistant hypocalcaemia. For more information see Endocrinology Guidelines http://online.tg.org.au/ip/.

Rapid complete correction of severe abnormality can be dangerous, partial correction is generally the best immediate option. Hypercalcaemia is more dangerous than hypocalcaemia, avoid overtreatment – see Precautions.

Some post thyroidectomy patients may require oral calcitriol as well as calcium supplementation to boost calcium levels, for further information see the Endocrinology Guidelines at http://online.tg.org.au/ip/. Cholecalciferol is not suitable for this indication as the onset of action is 4-8 weeks (calcitriol is 1-3 days).
**Mild hypocalcaemia**
Corrected serum calcium 2.00-2.15 mmol/L.
No signs or symptoms.

No treatment necessary, just observation.

**Moderate hypocalcaemia (asymptomatic)**
Corrected serum calcium of 1.80-1.99 mmol/L.
ECG monitoring is not required unless treating Medical Officer determines the patient has an elevated risk of arrhythmia (including patients treated with digoxin who have other proarrhythmic risk factors – see Precautions). If uncertainty exists, discuss with Critical Care Unit Medical Staff.

Oral administration (should be used in preference to IV administration where possible)
Calcium 600 mg tablets, 1200 mg (2 tablets) orally bd

Administer 30 minutes after food if possible to ensure maximum absorption. Many medications lessen calcium absorption (and calcium lessens the absorption of many medications), seek Pharmacy advice or separate 2 hours from medication. Whilst variable, about 30% of calcium is absorbed from the gastrointestinal tract, giving approximately 800 mg elemental calcium dose per 24 hours. Patients treated with a PPI or H2 antagonist may not absorb calcium carbonate effectively as an acid environment is required - consider calcium citrate (250 mg tabs) or dispersible calcium (1000 mg tabs) instead.

IV administration
May be required where oral administration is impractical.

**GENERAL WARDS (via large peripheral vein or CVC)**
Calcium gluconate 2.2 mmol (10 mL from ONE vial) added to a 100 mL minibag of sodium chloride 0.9%, given by IV infusion over 1 hour.
Total volume = 110 mL.
Infusion rate = 110 mL/hr.

**CRITICAL CARE UNIT, ED, THEATRE (via CVC)**
Calcium gluconate 2.2 mmol (10 mL from ONE vial) added to a 100 mL minibag of sodium chloride 0.9%, given by IV infusion over 1 hour.
Total volume = 110 mL.
Infusion rate = 110 mL/hr.

**Severe or symptomatic hypocalcaemia**
Corrected serum calcium less than 1.8 mmol/L.
Signs (Chvostek’s and/or Trousseau’s) and/or symptoms (cramps, dysphonia, dysphagia, paraesthesiae, tetany, laryngospasm, convulsions).

**GENERAL WARDS (via large peripheral vein or CVC)**
**Management of the patient must be discussed with Critical Care Unit Medical Staff. ECG monitoring should be started as soon as practicable and transfer to the Critical Care Unit considered**
Whilst consulting with Critical Care Unit Medical Staff commence the following with Medical Staff in attendance.
Calcium gluconate 2.2 mmol (10 mL from ONE vial) added to a 100 mL minibag of sodium chloride 0.9%, given by IV infusion over 15-30 minutes.
Total volume = 110 mL.
Infusion rate = 220-440 mL/hr.
Severe or symptomatic hypocalcaemia (continued)

CRITICAL CARE UNIT, ED, THEATRE (via CVC)
**Requires continuous ECG monitoring, restricted to Critical Care Unit, ED, Theatre or MET**
Calcium gluconate 2.2 mmol (10 mL from ONE vial) added to a 100 mL minibag of sodium chloride 0.9%, given by IV infusion over 15-30 minutes.
Total volume = 110 mL.
Rate of infusion = 220-440 mL/hr.

Note: for fluid restricted ICU patients with a CVC see DRG0048: Antibiotic and Electrolyte volumes for fluid restricted ICU patients (via CVC only).

If still symptomatic post dose seek Medical advice. Repeat blood tests (see Monitoring) and/or dose if clinically indicated.

For all other indications (non-hypocalcaemia)
- Adjunct in treatment of severe hyperkalaemia (serum potassium greater than 7.0 mmol/L, or with ECG changes) not due to digoxin toxicity.
- Adjunct in treatment of severe hypermagnesaemia (serum magnesium greater than 2.0-2.5 mmol/L).
- Drug-induced QT prolongation and torsades de pointes with co-existing hypocalcaemia.
- Calcium channel blocker (verapamil, diltiazem) overdose – may require large doses, seek expert advice.

Emergency
**REQUIRES CONTINUOUS ECG MONITORING, RESTRICTED TO CRITICAL CARE UNIT, ED, THEATRE, CODE BLUE OR MET**
Calcium gluconate 2.2 mmol (10 mL from ONE vial) undiluted, administer by slow IV injection over 2-5 minutes.

Dose may need repeating depending on indication and response.

Non-emergency
**REQUIRES CONTINUOUS ECG MONITORING, RESTRICTED TO CRITICAL CARE UNIT, ED, THEATRE, OR MET**
Calcium gluconate 2.2 mmol (10 mL from ONE vial) added to a 100 mL minibag of sodium chloride 0.9%, given by IV infusion over 1 hour.
Total volume = 110 mL.
Infusion rate = 110 mL/hr.

Dose may need repeating depending on indication and response.

General Administration Information
- **Infusion preparation:**
  Mix infusion thoroughly after adding calcium gluconate to avoid inadvertently giving a more concentrated dose.
  Other compatible infusion fluid may be substituted for sodium chloride 0.9% when deemed necessary by the Medical Officer.
  Infusion stable for 24 hours.
- **Infusion pump:** Alaris® LVP with Guardrails
- **Routes of administration:**
  IV injection: Yes – only for emergency situations
IV intermittent infusion (15-60 minutes): Yes
IV continuous infusion: Yes
IM injection: No – see Contraindications
Subcut injection: No – see Contraindications

- **Compatible/incompatible IV drugs/fluids:**
  - Note: Ceftriaxone see Drug Interactions. Incompatible with magnesium and phosphate.
  - 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.**

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**MONITORING (INCLUDING BLOOD TESTS)**

- **Continuous ECG Monitoring** – see Dosage and Administration.
- **Hypocalcaemia** – serum corrected calcium, albumin, magnesium, phosphate, creatinine and alkaline phosphatase at baseline and post IV dose (if patient still symptomatic seek Medical advice immediately, or if asymptomatic repeat bloods at 6-12 hours).
- **Patients with or prone to renal calculi** – require increased fluid intake, seek specialist advice.
- **Patients with a significantly abnormal albumin concentration should have ionised calcium measured.**

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**NURSING PRACTICE POINTS**

- Solution in vial should be clear and colourless, do not use if precipitate is present (this can occur). Visually inspect each vial prior to drawing up.
- Administer via a CVC or a large peripheral vein. See Dosage and Administration.
- Monitor IV injection/infusion site for venous irritation or extravasation (see Precautions and Adverse Effects). If extravasation occurs cease infusion immediately and contact Medical Officer.
- Where ECG monitoring is required, begin as soon as practicable and monitor continuously during calcium gluconate administration. Look for bradycardia, hypotension and arrhythmias.
- Report any signs of hypercalcaemia (polyuria, thirst, muscle weakness, nausea, vomiting, anorexia, abdominal pain, confusion) to Medical Officer.
- Dizziness may occur, especially with IV injection, lay patient down if required.
- Blood tests as ordered by the Medical Officer – see Monitoring.

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**ADVERSE EFFECTS**

- **Rapid IV injection** – can cause severe venous irritation, vasodilatation, hot flushes, decreased blood pressure, bradycardia, cardiac arrhythmias, syncope and cardiac arrest.
- **IV injection/infusion site** – venous irritation, calcification of injection site, skin necrosis (from extravasation). Early signs of extravasation may be skin redness, rash, pain, burning at injection site.
- **Common** – hypotension, dizziness, irregular heartbeat, nausea, vomiting, sweating, tingling sensations, sensation of heat or oppression, chalky taste, transient increase in BP.
- **Rare** – hypercalcaemia (especially in chronic renal failure).

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**DRUG PRESENTATIONS, LOCATION AND STORAGE**

Calcium gluconate 2.2 mmol in 10 mL vials. This is equivalent to 1 g or 10%.
Contains 2.2 mmol of calcium per 10 mL (three times less calcium than calcium chloride 1 g/10 mL (10%) vials).
Vial also contains calcium saccharate as a stabiliser.
Imprest Locations (at the time of guideline development): CCU, ED, Theatre, 5N, Day Onc, SCN, Maternity Outpatients, MET/Code Blue resuscitation drug pack.
Store below 30°C.