Glucagon – Standard Concentration

Newborn use only

2025

Indication	Management of neonatal hypoglycaemia: • Refractory to intravenous glucose infusions • When glucose infusion is unavailable Management of hyperinsulinaemic hypoglycaemia (e.g. congenital hyperinsulinism). Adjunctive treatment of beta-blocker overdose.
Action	Stimulates hepatic gluconeogenesis and glycogenolysis. Glucagon has a positive inotropic action.
Drug type	Polypeptide hormone – hyperglycaemic agent
Trade name	GlucaGen HypoKit 1 mg/mL
Presentation	1 mg/mL vial. 1 unit of glucagon = 1 mg (1000 microgram) glucagon
Dose	**IV bolus/IM/SC** 200 microgram/kg/dose. Do not exceed 1 mg/dose. IV glucose is to be administered as soon as possible. **IV infusion** 5–20 microgram/kg/hour. Consider starting dose of 20 microgram/kg/hour and decrease carefully, monitoring blood glucose, until the minimum effective dose is reached. **Beta-blocker overdose:** Refer to evidence summary.
Dose adjustment	Therapeutic hypothermia – No information. ECMO – NO information. Renal impairment – No information. Hepatic impairment – No information.
Maximum dose	Maximum stat dose: 1 mg (1000 microgram)
Route	IV, IM, SC
Preparation	**IV bolus/IM/SC:** Reconstitute 1 mg (1000 microgram) glucagon vial with 1 mL of diluent provided (water for injection) to make a 1 mg/mL (1000 microgram/mL) solution. **IV infusion**: **Note: Refer to Appendix for tables to assist with concentration selection.** **Weight suggestions for infusion concentrations below are a guide only. Clinicians may choose infusion concentration different to the suggested based on expected dose and the corresponding 24-hour fluid volumes**

Infant weight	<1kg	1 to 2.5kg	>2.5kg
Suggested glucagon concentration	**40 microgram/mL**	**80 microgram/mL**	**160 microgram/mL**
10 microgram/kg/hour is equal to	0.25 mL/kg/hour	0.125 mL/kg/hour	0.0625 mL/kg/hour

<table>
<tr>
<td></td>
<td>
<u>20mL Syringe</u>
Reconstitution: Add 1 mL of diluent provided (water for injection) to the 1 mg vial (1000 microgram) of glucagon to make a 1mg/mL (1000 microgram/mL) solution.

It is a 2-step dilution for the 40 microgram/mL solution only. It is a 1-step dilution for the 80 and 160 microgram/mL concentrations.
Step 1: Draw up glucagon reconstitution and add compatible fluid* to make a diluted solution as per table below:
<table>
<tr><th>Glucagon concentration</th><th>40 microgram/mL</th><th>80 microgram/mL</th><th>160 microgram/mL</th></tr>
<tr><td>Volume of glucagon reconstitution (1 mg/mL)</td><td>1 mL
(1 mg)</td><td>1.6 mL
(1.6 mg)</td><td>3.2 mL
(3.2 mg)</td></tr>
<tr><td>Volume of compatible fluid*</td><td>4 mL</td><td>18.4 mL</td><td>16.8 mL</td></tr>
<tr><td>Total volume</td><td>5 mL
(200 microgram/mL)</td><td>20 mL</td><td>20 mL</td></tr>
</table>
Step 2: Draw up diluted glucagon and add compatible fluid* as per table below to make a final volume of 20 mL
<table>
<tr><th>Glucagon concentration</th><th>40 microgram/mL</th></tr>
<tr><td>Volume of diluted glucagon from step 1</td><td>4 mL
(800 microgram)</td></tr>
<tr><td>Volume of compatible fluid*</td><td>16 mL</td></tr>
<tr><td>Total volume</td><td>20 mL</td></tr>
</table>
* Compatible fluid: glucose 5%

<u>50mL Syringe</u>
Reconstitution: Add 1 mL of diluent provided (water for injection) to the 1 mg vial (1000 microgram) of glucagon to make a 1 mg/mL (1000 microgram/mL) solution.
Draw up reconstituted glucagon and add compatible fluid* as per table below to make a final volume of 50 mL
<table>
<tr><th>Glucagon concentration</th><th>40 microgram/mL</th><th>80 microgram/mL</th><th>160 microgram/mL</th></tr>
<tr><td>Volume of glucagon (1 mg/mL)</td><td>2 mL
(2 mg)</td><td>4 mL
(4 mg)</td><td>8 mL
(8 mg)</td></tr>
<tr><td>Volume of compatible fluid*</td><td>48 mL</td><td>46 mL</td><td>42 mL</td></tr>
<tr><td>Total volume</td><td>50 mL</td><td>50 mL</td><td>50 mL</td></tr>
</table>
* Compatible fluid: glucose 5%
</td>
</tr>
<tr><td>Administration</td><td>Do not use the reconstituted solution unless it is clear.
IV bolus: Administer 0.2 mL/kg of the reconstituted solution (to a maximum 1 mL) over 3 to 5 minutes.
IM: Inject into the anterolateral thigh (preferred) or the ventrogluteal areas.[1,2].
SC: Inject into the area over the deltoid muscle or over the anterolateral thigh.[1,3]
Continuous IV infusion: Via syringe driver.</td></tr>
<tr><td>Monitoring</td><td>Blood glucose concentrations, watch for rebound hypoglycaemia after cessation.
Consider cardiorespiratory and blood pressure monitoring.
Electrolytes for continuous infusion.</td></tr>
<tr><td>Contraindications</td><td>Phaeochromocytoma[4-6], glucagonoma.
Hypersensitivity to glucagon or any component.</td></tr>
<tr><td>Precautions</td><td>Hypertension.
Insulinoma: Glucagon has been used to treat hypoglycaemia caused by insulinoma. However, it should be used cautiously because of the propensity to release insulin.[7]</td></tr>
<tr><td>Drug interactions</td><td>Drug interactions largely unreported in newborn infants.
Glucagon has a positive inotropic action which may counteract effect of beta-blockers. Beta-blockers may reduce hyperglycaemic effect of glucagon.[8]
Warfarin: Increased effect of warfarin resulting in increased risk of bleeding.[9]</td></tr>
</table>

	Indomethacin: Glucagon may lose its ability to raise blood glucose or paradoxically may even produce hypoglycaemia.[7]
Overdose	AUSTRALIA: Contact the Poisons Information Centre on **13 11 26** for management NEW ZEALAND: Contact the National Poisons Centre on **0800 764 766** for management
Adverse reactions	Generally well tolerated. Transient increase in blood pressure and pulse rate.[7] Anaphylaxis or hypersensitivity reactions have been reported in adults.[7] Very rare: Hypertension, hypotension, vomiting.[7] Erythema necrolyticum migrans (erythematosquamous skin lesions) has been reported with prolonged glucagon infusion.
Compatibility	**Fluids:** Glucose 5%.[21] **PN at Y-site:** No information **Y-site:** naloxone.
Incompatibility	**Fluids:** Solutions that contain calcium. **PN at Y-site:** No information **Y-site:** No information.
Stability	Discard any unused solution. Continuous IV infusion should be used within 24 hours
Storage	Store below 25°C. Do not freeze. The sealed container should be protected from light.
Excipients	Lactose monohydrate, hydrochloric acid (for pH adjustment), sodium hydroxide (for pH adjustment), and water for injections.
Evidence	**Efficacy** **Treatment of hypoglycaemia:** The data are mainly derived from case series and case reports.[10-13] A single bolus dose of glucagon (200 microgram/kg) caused a rapid rise in hepatic glucose production rate in newborns with hypoglycaemia.[12] (LOE IV) Glucagon infusion (0.5–1 mg/day = 20–40 microgram/hour) resulted in a significant rise in blood glucose concentration within 4 hours of infusion in newborn infants irrespective of the cause of hypoglycaemia.[13] (LOE IV, GOR C). Glucose production in response to a glucagon 100 microgram/kg bolus was comparable in preterm, Appropriately Grown for Age and Small for Gestational Age infants.[14] (LOE IV). Glucagon infusion (20–40 microgram/hour) has been used to treat refractory hypoglycaemia in sick preterm infants (mean birth weight 1814 g and gestational age 32 weeks).[11] (LOE IV) **Treatment of low-output heart failure associated with beta-blocker overdose:** A case report of a preterm infant with low output heart failure after maternal labetalol use who responded to repeated use of intravenous glucagon 0.3 to 0.6 mg/kg.[15] (LOE IV GOR C). This is consistent with doses in case reports of glucagon use for adult beta-blocker overdose.[16] **Safety** Hyponatraemia has been variably reported with glucagon infusion[13,17,18] although it may be explained by other factors including glucose infusion. (LOE IV GOR D) Thrombocytopenia has been reported[13,17] although a case series found increasing platelet counts during infusion.[11] Erythema necrolyticum migrans (erythematosquamous skin lesions) has been reported with prolonged glucagon infusion.[19,20] Glucagon has been reported to induce hypertension in patients with phaeochromocytoma.[8,10,11] Adverse cardiovascular events attributable to glucagon have not been reported in newborns. **Pharmacodynamics** An effect on blood glucose is usually seen within 5–20 minutes after IV, IM or SC administration.[11] Response to an intravenous bolus persists for at least 45 minutes.[13] **Pharmacokinetics** Adult data report half-life of 8–18 minutes.[7]
References	1. Australian Technical Advisory Group on Immunisation (ATAGI). Australian Immunisation Handbook, Australian Government Department of Health and Aged Care, Canberra, 2022, immunisationhandbook.health.gov.au. Accessed on 27/11/2025. 2. Rishovd A. Pediatric intramuscular injections: guidelines for best practice. MCN Am J Matern Child Nurs. 2014;39:107-12; quiz 13-4. 3. Hensel D, Morson GL, Preuss EA. Best practices in newborn injections. MCN Am J Matern Child Nurs. 2013;38:163-7; quiz 8-9. 4. Hosseinnezhad A, Black RM, Aeddula NR, Adhikari D, Trivedi N. Glucagon-induced pheochromocytoma crisis. Endocr Pract. 2011;17:e51-4.

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Appendix

Infusion tables to assist concentration selection

Table 1: Infusion rates when using glucagon concentration **40 microgram/mL**
(suggested for weight <1kg)

Rate (mL/hr)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Weight (kg)	**Approximate micrograms/kg/hour**									
0.5	8	16	24	32	40	48	56	64	72	80
1	4	8	12	16	20	24	28	32	36	40
1.5	2.7	5.3	8	11	13	16	18	21	24	27
2	2	4	6	8	10	12	14	16	18	20
2.5	1.6	3.2	4.8	6.4	8	9.6	11	13	14	16
3	1.3	2.7	4	5.3	6.7	8	9.3	11	12	13
3.5	1.1	2.3	3.4	4.6	5.7	6.9	8	9.1	10	11
4	1	2	3	4	5	6	7	8	9	10
4.5	0.9	1.8	2.7	3.6	4.4	5.3	6.2	7.1	8	8.9
5	0.8	1.6	2.4	3.2	4	4.8	5.6	6.4	7.2	8

Table 2: Infusion rates when using glucagon concentration **80 microgram/mL**
(suggested for weight 1 to 2.5kg)

Rate (mL/hr)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Weight (kg)	**Approximate micrograms/kg/hour**									
0.5	16	32	48	64	80	96	112	128	144	160
1	8	16	24	32	40	48	56	64	72	80
1.5	5.3	11	16	21	27	32	37	43	48	53
2	4	8	12	16	20	24	28	32	36	40
2.5	3.2	6.4	9.6	13	16	19	22	26	29	32
3	2.7	5.3	8	11	13	16	19	21	24	27
3.5	2.3	4.6	6.9	9.1	11	14	16	18	21	23
4	2	4	6	8	10	12	14	16	18	20
4.5	1.8	3.6	5.3	7.1	8.9	11	12	14	16	18
5	1.6	3.2	4.8	6.4	8	10	11	13	14	16

Table 3: Infusion rates when using glucagon concentration **160 microgram/mL**
(suggested for weight >2.5kg)

Rate (mL/hr)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Weight (kg)	**Approximate micrograms/kg/hour**									
0.5	32	64	96	128	160	192	224	256	288	320
1	16	32	48	64	80	96	112	128	144	160
1.5	11	21.3	32	43	53	64	75	85	96	107
2	8	16	24	32	40	48	56	64	72	80
2.5	6.4	13	19	26	32	38	45	51	58	64
3	5.3	11	16	21	27	32	37	43	48	53
3.5	4.6	9.1	14	18	23	27	32	37	41	46
4	4	8	12	16	20	24	28	32	36	40
4.5	3.6	7.1	11	14	18	21	25	28	32	36
5	3.2	6.4	9.6	13	16	19	22	26	29	32

$$\text{Rate (mL/hr)} = \frac{\text{Dose (microgram/kg/hour) x Weight (kg)}}{\text{Concentration (microgram/mL)}}$$

$$\text{Dose (microgram/kg/hour)} = \frac{\text{Rate (mL/hr) x Concentration (microgram/mL)}}{\text{Weight (kg)}}$$

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