

<b>Indication</b>	<p>Management of neonatal hypoglycaemia:</p> <ul style="list-style-type: none"> <li>• Refractory to intravenous glucose infusions</li> <li>• When glucose infusion is unavailable</li> </ul> <p>Management of hyperinsulinaemic hypoglycaemia (e.g. congenital hyperinsulinism). Adjunctive treatment of beta-blocker overdose.</p>												
<b>Action</b>	Stimulates hepatic gluconeogenesis and glycogenolysis. Glucagon has a positive inotropic action.												
<b>Drug type</b>	Polypeptide hormone – hyperglycaemic agent												
<b>Trade name</b>	GlucaGen HypoKit 1 mg/mL												
<b>Presentation</b>	1 mg/mL vial. 1 unit of glucagon = 1 mg (1000 microgram) glucagon												
<b>Dose</b>	<p><b>IV bolus/IM/SC</b> 200 microgram/kg/dose. Do not exceed 1 mg/dose. IV glucose is to be administered as soon as possible.</p> <p><b>IV infusion</b> 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.</p> <p><b>Beta-blocker overdose:</b> Refer to evidence summary.</p>												
<b>Dose adjustment</b>	<p>Therapeutic hypothermia – No information. ECMO – NO information. Renal impairment – No information. Hepatic impairment – No information.</p>												
<b>Maximum dose</b>	Maximum stat dose: 1 mg (1000 microgram)												
<b>Route</b>	IV, IM, SC												
<b>Preparation</b>	<p><b>IV bolus/IM/SC:</b> 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.</p> <p><b>IV infusion:</b> <b>Note:</b> Refer to <a href="#">Appendix</a> for tables to assist with concentration selection.</p> <p><b>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</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Infant weight</th> <th style="text-align: center;">&lt;1kg</th> <th style="text-align: center;">1 to 2.5kg</th> <th style="text-align: center;">&gt;2.5kg</th> </tr> </thead> <tbody> <tr> <td style="text-align: left;"><b>Suggested glucagon concentration</b></td> <td style="text-align: center;"><b>40 microgram/mL</b></td> <td style="text-align: center;"><b>80 microgram/mL</b></td> <td style="text-align: center;"><b>160 microgram/mL</b></td> </tr> <tr> <td style="text-align: left;"><b>10 microgram/kg/hour is equal to</b></td> <td style="text-align: center;">0.25 mL/kg/hour</td> <td style="text-align: center;">0.125 mL/kg/hour</td> <td style="text-align: center;">0.0625 mL/kg/hour</td> </tr> </tbody> </table>	Infant weight	<1kg	1 to 2.5kg	>2.5kg	<b>Suggested glucagon concentration</b>	<b>40 microgram/mL</b>	<b>80 microgram/mL</b>	<b>160 microgram/mL</b>	<b>10 microgram/kg/hour is equal to</b>	0.25 mL/kg/hour	0.125 mL/kg/hour	0.0625 mL/kg/hour
Infant weight	<1kg	1 to 2.5kg	>2.5kg										
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	<p><b><u>20mL Syringe</u></b></p> <p><b>Reconstitution:</b> Add 1 mL of diluent provided (water for injection) to the 1 mg vial (1000 microgram) of glucagon to make a <b>1 mg/mL (1000 microgram/mL) solution</b>.</p> <p>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.</p> <p><b>Step 1:</b> Draw up glucagon reconstitution and add compatible fluid* to make a diluted solution as per table below:</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-bottom: 10px;"> <thead> <tr> <th style="width: 30%;">Glucagon concentration</th> <th style="width: 20%;">40 microgram/mL</th> <th style="width: 20%;">80 microgram/mL</th> <th style="width: 30%;">160 microgram/mL</th> </tr> </thead> <tbody> <tr> <td><b>Volume of glucagon reconstitution (1 mg/mL)</b></td> <td style="text-align: center;">1 mL (1 mg)</td> <td style="text-align: center;">1.6 mL (1.6 mg)</td> <td style="text-align: center;">3.2 mL (3.2 mg)</td> </tr> <tr> <td><b>Volume of compatible fluid*</b></td> <td style="text-align: center;">4 mL</td> <td style="text-align: center;">18.4 mL</td> <td style="text-align: center;">16.8 mL</td> </tr> <tr> <td><b>Total volume</b></td> <td style="text-align: center;">5 mL <b>(200 microgram/mL)</b></td> <td style="text-align: center;">20 mL</td> <td style="text-align: center;">20 mL</td> </tr> </tbody> </table> <p><b>Step 2:</b> Draw up diluted glucagon and add compatible fluid* as per table below to make a final volume of 20 mL</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-bottom: 10px;"> <thead> <tr> <th style="width: 40%;">Glucagon concentration</th> <th style="width: 60%;">40 microgram/mL</th> </tr> </thead> <tbody> <tr> <td><b>Volume of diluted glucagon from step 1</b></td> <td style="text-align: center;">4 mL (800 microgram)</td> </tr> <tr> <td><b>Volume of compatible fluid*</b></td> <td style="text-align: center;">16 mL</td> </tr> <tr> <td><b>Total volume</b></td> <td style="text-align: center;">20 mL</td> </tr> </tbody> </table> <p>* Compatible fluid: glucose 5%</p> <p><b><u>50mL Syringe</u></b></p> <p><b>Reconstitution:</b> Add 1 mL of diluent provided (water for injection) to the 1 mg vial (1000 microgram) of glucagon to make a <b>1 mg/mL (1000 microgram/mL) solution</b>.</p> <p>Draw up reconstituted glucagon and add compatible fluid* as per table below to make a final volume of 50 mL</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-bottom: 10px;"> <thead> <tr> <th style="width: 30%;">Glucagon concentration</th> <th style="width: 20%;">40 microgram/mL</th> <th style="width: 20%;">80 microgram/mL</th> <th style="width: 30%;">160 microgram/mL</th> </tr> </thead> <tbody> <tr> <td><b>Volume of glucagon (1 mg/mL)</b></td> <td style="text-align: center;">2 mL (2 mg)</td> <td style="text-align: center;">4 mL (4 mg)</td> <td style="text-align: center;">8 mL (8 mg)</td> </tr> <tr> <td><b>Volume of compatible fluid*</b></td> <td style="text-align: center;">48 mL</td> <td style="text-align: center;">46 mL</td> <td style="text-align: center;">42 mL</td> </tr> <tr> <td><b>Total volume</b></td> <td style="text-align: center;">50 mL</td> <td style="text-align: center;">50 mL</td> <td style="text-align: center;">50 mL</td> </tr> </tbody> </table> <p>* Compatible fluid: glucose 5%</p>	Glucagon concentration	40 microgram/mL	80 microgram/mL	160 microgram/mL	<b>Volume of glucagon reconstitution (1 mg/mL)</b>	1 mL (1 mg)	1.6 mL (1.6 mg)	3.2 mL (3.2 mg)	<b>Volume of compatible fluid*</b>	4 mL	18.4 mL	16.8 mL	<b>Total volume</b>	5 mL <b>(200 microgram/mL)</b>	20 mL	20 mL	Glucagon concentration	40 microgram/mL	<b>Volume of diluted glucagon from step 1</b>	4 mL (800 microgram)	<b>Volume of compatible fluid*</b>	16 mL	<b>Total volume</b>	20 mL	Glucagon concentration	40 microgram/mL	80 microgram/mL	160 microgram/mL	<b>Volume of glucagon (1 mg/mL)</b>	2 mL (2 mg)	4 mL (4 mg)	8 mL (8 mg)	<b>Volume of compatible fluid*</b>	48 mL	46 mL	42 mL	<b>Total volume</b>	50 mL	50 mL	50 mL
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<b>Administration</b>	<p>Do not use the reconstituted solution unless it is clear.</p> <p><b>IV bolus:</b> Administer 0.2 mL/kg of the reconstituted solution (to a maximum 1 mL) over 3 to 5 minutes.</p> <p><b>IM:</b> Inject into the anterolateral thigh (preferred) or the ventrogluteal areas.<sup>1,2</sup></p> <p><b>SC:</b> Inject into the area over the deltoid muscle or over the anterolateral thigh.<sup>1,3</sup></p> <p><b>Continuous IV infusion:</b> Via syringe driver.</p>																																								
<b>Monitoring</b>	<p>Blood glucose concentrations, watch for rebound hypoglycaemia after cessation.</p> <p>Consider cardiorespiratory and blood pressure monitoring.</p> <p>Electrolytes for continuous infusion.</p>																																								
<b>Contraindications</b>	<p>Phaeochromocytoma<sup>4-6</sup>, glucagonoma.</p> <p>Hypersensitivity to glucagon or any component.</p>																																								
<b>Precautions</b>	<p>Hypertension.</p> <p>Insulinoma: Glucagon has been used to treat hypoglycaemia caused by insulinoma. However, it should be used cautiously because of the propensity to release insulin.<sup>7</sup></p>																																								
<b>Drug interactions</b>	<p>Drug interactions largely unreported in newborn infants.</p> <p>Glucagon has a positive inotropic action which may counteract effect of beta-blockers. Beta-blockers may reduce hyperglycaemic effect of glucagon.<sup>8</sup></p> <p>Warfarin: Increased effect of warfarin resulting in increased risk of bleeding.<sup>9</sup></p>																																								

	Indomethacin: Glucagon may lose its ability to raise blood glucose or paradoxically may even produce hypoglycaemia. <sup>7</sup>
<b>Overdose</b>	AUSTRALIA: Contact the Poisons Information Centre on <b>13 11 26</b> for management  NEW ZEALAND: Contact the National Poisons Centre on <b>0800 764 766</b> for management
<b>Adverse reactions</b>	Generally well tolerated. Transient increase in blood pressure and pulse rate. <sup>7</sup> Anaphylaxis or hypersensitivity reactions have been reported in adults. <sup>7</sup> Very rare: Hypertension, hypotension, vomiting. <sup>7</sup> Erythema necrolyticum migrans (erythematous squamous skin lesions) has been reported with prolonged glucagon infusion.
<b>Compatibility</b>	<b>Fluids:</b> Glucose 5%. <sup>21</sup> <b>PN at Y-site:</b> No information <b>Y-site:</b> naloxone.
<b>Incompatibility</b>	<b>Fluids:</b> Solutions that contain calcium. <b>PN at Y-site:</b> No information <b>Y-site:</b> No information.
<b>Stability</b>	Discard any unused solution. Continuous IV infusion should be used within 24 hours
<b>Storage</b>	Store below 25°C. Do not freeze. The sealed container should be protected from light.
<b>Excipients</b>	Lactose monohydrate, hydrochloric acid (for pH adjustment), sodium hydroxide (for pH adjustment), and water for injections.
<b>Evidence</b>	<b>Efficacy</b> <b>Treatment of hypoglycaemia:</b> The data are mainly derived from case series and case reports. <sup>10-13</sup> A single bolus dose of glucagon (200 microgram/kg) caused a rapid rise in hepatic glucose production rate in newborns with hypoglycaemia. <sup>12</sup> (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. <sup>13</sup> (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. <sup>14</sup> (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). <sup>11</sup> (LOE IV) <b>Treatment of low-output heart failure associated with beta-blocker overdose:</b> 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. <sup>15</sup> (LOE IV GOR C). This is consistent with doses in case reports of glucagon use for adult beta-blocker overdose. <sup>16</sup> <b>Safety</b> Hyponatraemia has been variably reported with glucagon infusion <sup>13,17,18</sup> although it may be explained by other factors including glucose infusion. (LOE IV GOR D) Thrombocytopenia has been reported <sup>13,17</sup> although a case series found increasing platelet counts during infusion. <sup>11</sup> Erythema necrolyticum migrans (erythematous squamous skin lesions) has been reported with prolonged glucagon infusion. <sup>19,20</sup> Glucagon has been reported to induce hypertension in patients with pheochromocytoma. <sup>8,10,11</sup> Adverse cardiovascular events attributable to glucagon have not been reported in newborns. <b>Pharmacodynamics</b> An effect on blood glucose is usually seen within 5–20 minutes after IV, IM or SC administration. <sup>11</sup> Response to an intravenous bolus persists for at least 45 minutes. <sup>13</sup> <b>Pharmacokinetics</b> Adult data report half-life of 8–18 minutes. <sup>7</sup>
<b>References</b>	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. Hosseinneshad 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

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

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

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Original 1.0	27/02/2026
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This standard concentration formulary has been developed by the ANMF standard concentration working group. The working group (in alphabetical order): Mohammad Irfan Azeem, Susannah Brew, Cindy Chen, Michelle Jenkins, Kerrie Knox, Rebecca O’Grady

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