 <b>Waikato District Health Board</b>		Type: <b>Drug Guideline</b>	Document reference: <b>2939</b>	Manual Classification: <b>Waikato DHB Drug Guidelines</b>
Title: <b>Midazolam for Neonates</b>			Effective date: <b>30 March 2022</b>	
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## BRIEF ADMINISTRATION GUIDE

For detailed information refer to [The Australasian Neonatal Medicines Formulary midazolam guideline](#)



**Critical Note:** there are minor variations between the ANMF and Waikato DHB best practice within this drug guideline – see **yellow shaded text**

- Indications**
- Sedation – caution in preterm babies
  - Seizure control
  - **Terminal agitation or breathlessness in Palliative Care**

**Route:** Intravenous, intranasal, sublingual, buccal, intramuscular or oral

- Supplied as midazolam 15mg/3mL (5 mg/mL) ampoule (ampoule suitable to use for all routes of administration).  
**Note: check concentration carefully as another exists**
- pH of midazolam is 2.9 - 3.7

- Dose:**
- Sedation
- **Continuous IV Infusion:** 0.2 - 1 microgram/kg/min by continuous IV infusion, adjusted according to response. Maximum rate 2 microgram/kg/min
  - **IV Injection:** 50 – 150 microgram/kg by bolus IV injection, may be repeated as required every 2 to 4 hours
  - **Intra-Nasal / Buccal:** 200 micrograms/kg.  
Dose range: 200-300 micrograms/kg/dose. May be repeated after 10 minutes.
  - **IM:** 50 micrograms/kg/dose every 4 hours when required.  
Dose range: 50-150 micrograms/kg/dose.
  - **Oral:** 250 microgram/kg
- Seizure Control
- Loading dose: 150 microgram/kg by intravenous injection
  - Maintenance dose: initially 1 microgram/kg/min by continuous IV infusion
  - Increase dose by 1 microgram/kg/min every 15 minutes until seizures are controlled. Maximum rate 7 microgram/kg/min
- Palliative Care
- Buccal: 100 microgram/kg
  - Subcut or IV infusion: 30 – 150 microgram/kg/hour


## Preparation and administration

**Compatible fluids:** glucose 5%, glucose 10%, sodium chloride 0.9%

### Continuous IV Infusion

- Select the **standard concentration** of midazolam required based on the weight of the infant and in the context of any fluid restrictions, and prepare as per the table below:

Final Midazolam Concentration	200 microgram/mL	500 microgram/mL
Volume of midazolam (15mg/ 3mL)	2 mL	3 mL
Volume of compatible fluid	48 mL	27 mL
<b>Total volume</b>	<b>50 mL</b>	<b>30 mL</b>

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- Administer via continuous IV infusion at the prescribed rate using a syringe driver with Guardrails settings 'midazolam' or 'midazolam (seizure)' as appropriate

$$\text{Rate (mL/hr)} = \frac{60 \times \text{Dose (microgram/kg/min)} \times \text{Weight (kg)}}{\text{Concentration (microgram/mL)}}$$

#### Direct IV Injection

- If a continuous infusion of midazolam is already running then alter Guardrails drug choice temporarily (use the ? button then select Infusion Setup) to 'midazolam (bolus)' and administer as prescribed
- If no continuous infusion is running then draw up 0.4 mL (2000 micrograms) from ampoule and add 9.6 mL of compatible fluid to make a final volume of 10mL with concentration of **200 micrograms/mL**  
Note: Maximum recommended concentration is 1000 microgram/mL.  
To prepare this; draw up 1 mL (5000 micrograms) from ampoule and add 4 mL of compatible fluid to make a final solution of 5000 micrograms / 5 mL = 1000 micrograms/mL
- Draw up required dose
- Administer by slow IV injection **over 10 minutes** or if using for **seizures over 3 - 5 minutes** using a syringe driver with Guardrails settings 'midazolam (bolus)'
- Flush before and after administration with compatible fluid at the same rate as the midazolam

#### Intra-Nasal

- Draw up the prescribed dose from the ampoule using a syringe. Then draw syringe back allowing air to remain behind dose ready for administration. Attached syringe to intranasal mucosal atomizer device (located on IV trolley) and insert into nostril of infant and administer dose rapidly.

#### Buccal

- Draw up the prescribed dose from the ampoule and administer into the mouth

#### IM

- Draw up 0.4mL (2000 micrograms) from ampoule and add 9.6mL of sodium chloride 0.9% to make final volume of 10mL with concentration of 200 micrograms/mL
- Then draw up prescribed dose and inject deep into a large muscle as per [Lippincott](#).

#### Oral


- Draw up the prescribed dose from the ampoule and administer orally as per NICU guideline "[Dilution of oral medication and osmolality management in NICU](#)", ref number 6083

### **Monitoring**

- Continuous cardiorespiratory monitoring
- Monitor blood pressure, heart rate, respiratory rate and oxygen saturation
- Monitor the level of sedation using the Neonatal Pain and Sedation Score (NPASS), where indicated
- Monitor seizure activity, where indicated
- Monitor for signs of withdrawal after prolonged therapy
- Monitor for signs of extravasation

### **Storage and Stability**

- Diluted solutions are stable for up to 24 hours when refrigerated (2 – 8 °C)

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## 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. For CVAD administration Neonatal specific competency NCV/NAC and NIC2 is also required.

## Guardrails

Midazolam is Guardrail profiled on the CC pump for NICU as **three entries; ensure you have selected the correct entry**. Following are the guardrail limits:


Guardrails Drug Name	Midazolam	Midazolam (bolus)*	Midazolam (seizure)
<b>Concentration (mcg/ml)</b>			
Minimum	100	100	100
Maximum	1000	1000	1000
<b>Dose rate (mcg/kg/min)</b>			
Default	0.5	10	1
Soft minimum	0.2	5	0.9
Soft maximum	1.5	15	5
Hard max	2	30	7

## References

- Australasian Neonatal Medicines Formulary (ANMF). Accessed 20<sup>th</sup> April 2020. Available from: [https://www.seslhd.health.nsw.gov.au/sites/default/files/groups/Royal\\_Hospital\\_for\\_Women/Neonatal/Neomed/neomed21midazolamANMF.pdf](https://www.seslhd.health.nsw.gov.au/sites/default/files/groups/Royal_Hospital_for_Women/Neonatal/Neomed/neomed21midazolamANMF.pdf)
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## Appendix

### Infusion tables to assist concentration selection

**Table 1:** Infusion rates when using midazolam concentration **200 microgram/mL**  
(most useful for neonates up to 4 kg)

Rate (mL/hr)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Weight (kg)	<b>Approximate micrograms/kg/minute</b>									
0.5	0.67	1.33	2	2.67	3.33	4	4.67	5.33	6	6.67
1	0.33	0.67	1	1.33	1.67	2	2.33	2.67	3	3.33
1.5	0.22	0.44	0.67	0.89	1.11	1.33	1.56	1.78	2	2.22
2	0.17	0.33	0.5	0.67	0.83	1	1.17	1.33	1.5	1.67
2.5	0.13	0.27	0.4	0.53	0.67	0.8	0.93	1.07	1.2	1.33
3	0.11	0.22	0.33	0.44	0.56	0.67	0.78	0.89	1	1.11
3.5	0.10	0.19	0.29	0.38	0.48	0.57	0.67	0.76	0.86	0.95
4	0.08	0.17	0.25	0.33	0.42	0.5	0.58	0.67	0.75	0.83
4.5	0.07	0.15	0.22	0.30	0.37	0.44	0.52	0.59	0.67	0.74
5	0.07	0.13	0.2	0.27	0.33	0.4	0.47	0.53	0.6	0.67

**Table 3:** Infusion rates when using midazolam concentration **500 microgram/mL**  
(most useful for neonates > 4 kg)

Rate (mL/hr)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Weight (kg)	<b>Approximate micrograms/kg/minute</b>									
2.5	0.33	0.67	1	1.33	1.67	2	2.3	2.7	3	3.3
3	0.28	0.56	0.83	1.11	1.39	1.67	1.94	2.2	2.5	2.8
3.5	0.24	0.48	0.71	0.95	1.19	1.43	1.67	1.9	2.14	2.38
4	0.21	0.42	0.63	0.83	1.04	1.25	1.46	1.67	1.88	2.08
4.5	0.19	0.37	0.56	0.74	0.93	1.11	1.3	1.48	1.67	1.85
5	0.17	0.33	0.5	0.67	0.8	1	1.17	1.33	1.5	1.7