Vecuronium
Newborn use only

2019

Alert	High-alert medication: High risk of causing significant patient harm when used in error. This drug should be administered in the presence of personnel trained in advanced airway management. Suggest regular cessation of infusion for a few to several hours, possibly every 24 hours (commonly referred to as 'drug holiday'[17]) to assess the need for continued paralysis and adequacy of sedation or analgesia. Line should be adequately flushed to avoid unintended paralysis during later use of the line.
Indication	1. Skeletal muscle relaxation or paralysis in mechanically ventilated infants. 2. For elective endotracheal intubation.
Action	Non-depolarising muscle relaxant that competitively antagonises acetylcholine antagonist at nicotinic acetylcholine receptors at neuromuscular junction. Onset of action is 1 to 2 minutes; duration of action is 30–40 minutes.
Drug Type	Non-depolarising neuromuscular blocking agent.
Trade Name	Vecuronium Bromide
Presentation	10 mg vial (powder for reconstitution)
Dosage/Interval	**Intubation** IV bolus – 0.1 mg/kg **Muscle relaxation** **Intermittent IV bolus** 0.1 mg/kg (0.03–0.15 mg/kg) IV push every 1 to 2 hours as needed.[3] **Continuous IV infusion (with or without loading dose)** 60-200 microg/kg/hour.[1,2] Titrate in 10% dose increments until desired neuromuscular blockade is achieved.
Route	IV
Maximum Dose	IV bolus: 0.2 mg/kg; IV infusion: 0.2 mg/kg/hour.[1,2,20,21]
Preparation/Dilution	**IV bolus:** Add 5 mL water for injection to 10 mg of vecuronium powder for reconstitution (2 mg/mL). Draw up 2 mL (4 mg of vecuronium) and add 2 mL of sodium chloride 0.9% to make a final volume of 4 mL with a concentration of 1 mg/mL. **IV infusion:** Infusion rate: 1 mL/hour = 100 microgram/kg/hour — Prescribed amount: 5 mg/kg vecuronium and make up to 50 mL Add 5 mL water for injection to 10 mg vecuronium powder for reconstitution (2 mg/mL). Draw up 2.5 mL/kg of solution (5 mg/kg of vecuronium) and add sodium chloride 0.9% or glucose 5% to make a final volume of 50 mL with a concentration of 100 microgram/kg/mL. Infusing at a rate of 1 mL/hour = 100 microgram/kg/hour.
Administration	IV bolus: Administer over several seconds.[19] IV infusion via syringe pump. Line should be adequately flushed to avoid unintended paralysis during later use of the line.
Monitoring	Continuous cardio-respiratory and pulse oximetry monitoring. Close monitoring of neuromuscular function, sedation and blood pressure (invasive or non-invasive) is essential. Monitor electrolytes and renal function.
Contraindications	Hypersensitivity to vecuronium or any component of the formulation. Cross-sensitivity with other neuromuscular-blocking agents may occur; use with extreme caution in patients with previous anaphylactic reactions.
Precautions	Avoid prolonged usage. **Factors which can increase duration of neuromuscular blockade:** Acidosis, hypothermia, neuromuscular disease, hepatic disease, hypokalaemia, hypermagnesaemia, renal failure and younger age.

	Factors which can decrease duration of neuromuscular blockade: Alkalosis and hyperkalaemia. Use cautiously in neonates with hepatic or renal impairment and in neonates with fluid and electrolyte imbalance. Suggest regular cessation of infusion, possibly every 24 hours (commonly referred to as 'drug holiday') to assess the need for continued paralysis and adequacy of sedation or analgesia. Monitoring of fluid balance is essential due to of risk of fluid retention.[15,17]
Drug Interactions	Aminoglycosides & general anaesthetics can increase (potentiate) duration of neuromuscular blockade. Corticosteroids: In addition to prolonging recovery from neuromuscular blockade, concomitant use with corticosteroids has been associated with development of acute quadriplegic myopathy syndrome (AQMS). Current adult guidelines recommend neuromuscular blockers be discontinued as soon as possible in patients receiving corticosteroids or interrupted daily until necessary to restart them based on clinical condition.[4] Adrenaline (epinephrine) can reduce (antagonise) duration of neuromuscular blockade.
Adverse Reactions	Hypoxaemia may occur because of inadequate ventilation and deterioration in pulmonary mechanics. Hypotension and bradycardia, particularly when used in combination with opioids. Prolonged paralysis after long-term use. Rare: Anaphylactic reaction.
Compatibility	Fluids: Glucose 5%, sodium chloride 0.9%. Compatible via Y-site: Glucose/amino acid solutions, alprostadil, aminophylline, amiodarone, cefazolin, cimetidine, dobutamine, dopamine, adrenaline (epinephrine), esmolol, fentanyl, fluconazole, gentamicin, heparin, hydrocortisone, isoprenaline, linezolid, lorazepam, midazolam, milrinone, morphine, nicardipine, nitroglycerin, nitroprusside, propofol, ranitidine, trimethoprim-suxamethonium and vancomycin.
Incompatibility	Fluids: No information. No information on lipid emulsions. Incompatible via Y site: Diazepam, furosemide, ibuprofen, lysine and micafungin, pantoprazole.
Stability	Diluted solution stable for up to 24 hours.
Storage	$\leq$ 25°C.
Special Comments	Muscle relaxation is reversed by neostigmine (50 microgram/kg) and atropine (20 microgram/kg). Sensation remains intact; sedation & analgesia should be used for painful procedures. Provide eye protection and instil lubricating eye drops every 2 hours. Vecuronium produces less tachycardia and hypotension when compared with pancuronium.[5,6] The neuromuscular blockade of vecuronium is of shorter duration than that of pancuronium.[6,7]
Evidence summary	**Efficacy** <u>Muscle relaxation</u> The potency of vecuronium is equal to or slightly greater than pancuronium.[7] (LOE II/Grade B) Vecuronium, although known to be shorter acting than pancuronium, tends to have a duration of action similar to that of long-acting neuromuscular blocking agents in neonates. This is because infants require lower plasma drug concentrations for 50% depression of neuromuscular function and because their volume of distribution is larger than children or adults.[8](LOE II/Grade B) A prospective study of continuous-infusion vecuronium, given to facilitate mechanical ventilation, was conducted in 11 infants and children and four neonates.[2] All patients received a bolus dose followed by a continuous infusion. The degree of neuromuscular blockade was assessed with TOF monitoring and a 10% adjustment in dose was made to maintain one twitch of TOF. The mean dose was not statistically significantly different between the infants-children group and the neonate group, with 0.14 ± 0.05 mg/kg/hour and 0.11 ± 0.05 mg/kg/hour, respectively ($p < 0.4$). Recovery time after discontinuation ranged from 27–80 minutes for all patients. Only in the infants-children group was there a positive

	correlation between duration of infusion and time to recovery (r = 0.76, p < 0.01). No adverse cardiovascular or toxic effects were noted. A prospective, dose-finding study with vecuronium continuous infusions was conducted in 12 infants and 18 children.[16] Patients did not receive a bolus dose. Neuromuscular blockade was assessed with TOF monitoring and the dose was titrated by 10% to maintain one twitch of TOF. A statistically significant increase in dose was required for patients older than 1 year versus those younger than 1 year (mean ± standard error of mean [SEM] 98.7 ± 7.07 vs 54.7 ± 4.23 microgram/kg/h, p = 0.0001). No tachyphylaxis was noted with prolonged duration of vecuronium. There was a statistically significant difference in recovery time after cessation of the infusion with a median recovery time of 45 minutes (interquartile range [IQR] 20–51 min) for infants and 65 minutes (IQR 55–103 min) for children (p = 0.0019). The time to spontaneous recovery was not influenced by duration of infusion. **Safety** Patients with hepatic and renal failure may experience prolonged neuromuscular blockade.[9,11](LOE II/Grade B) The active metabolite (3-desacetyl-vecuronium) is responsible for the cumulative effect seen with vecuronium administration and the prolonged blockade after long-term infusions in adult patients with renal failure.[13](LOE II/Grade B) **Pharmacokinetics** Hepatobiliary clearance is the primary route of elimination, accounting for approximately 50% of the dose. Vecuronium is metabolised rapidly in the liver to 3-desacetyl-vecuronium, which is 50–70% as potent as the parent compound. This metabolite is cleared primarily by renal elimination. Approximately 20–30% of vecuronium is excreted unchanged in urine.[9,11,12] Onset of action is 1 to 2 minutes; duration of action is 30–40 minutes (prolonged with higher doses and in preterm infants).[17,18]
References	1. Reich DL, Hollinger I, Harrington DJ, Seiden HS, Chakravorti S, Cook DR. Comparison of cisatracurium and vecuronium by infusion in neonates and small infants after congenital heart surgery. Anesthesiology. 2004;101(5):1122-1127. 2. Fitzpatrick KT, Black GW, Crean PM, Mirakhur RK. Continuous vecuronium infusion for prolonged muscle relaxation in children. Can J Anaesth 1991;38(2):169-174. 3. Costarino AT, Polin RA. Neuromuscular relaxants in the neonate. Clin Perinatol 1987;14(4):965-989. 4. Murray MJ, Cowen J, DeBlock H, et al, Clinical Practice Guidelines for Sustained Neuromuscular Blockade in the Adult Critically Ill Patient. Task Force of the American College of Critical Care Medicine (ACCM) of the Society of Critical Care Medicine (SCCM), American Society of Health-System Pharmacists, American College of Chest Physicians. Crit Care Med 2002;30(1):142-56. 5. Basta SJ, Savarese JJ, Ali HH et al. Vecuronium does not alter serum histamine within the clinical dose range. Anesthesiology 1983;59:A273. 6. Son SL, Waud BE, Waud DR. A comparison of the neuromuscular blocking and vagolytic effects of ORG NC45 and pancuronium . Anesthesiology 1981;55:12–18. 7. Krieg N, Crul JF, Booij LH. Relative potency of ORG NC 45, pancuronium, alcuronium and tubocurarine in anaesthetized man. Br J Anaesth 1980;52(8):783-8. 8. Meretoja OA. Is vecuronium a long-acting neuromuscular blocking agent in neonates and infants? Br J Anaesth 1989;62:184-187. 9. Bencini AF, Scaf AHJ, Sohn YJ, Kersten-Kleef UW, Agoston S. Hepatobiliary disposition of vecuronium bromide in man. Br J Anaesth 1986;58:988–95. 10. Martin LD, Bratton SL, O'Rourke PP. Clinical uses and controversies of neuromuscular blocking agents in infants and children. Crit Care Med 1999;27:1358–68. 11. Lynamd P, Cronnellry, Castagnoklip, Canfellpv C et al. The pharmacodynamics and pharmacokinetics of vecuronium in patients anesthetized with isoflurane with normal renal function or with renal failure. Anesthesiology 1988;69:227-31. 12. Fisher DM, Castagnoli K, Miller RD. Vecuronium kinetics and dynamics in anesthetized infants and children. Clin Pharmacol Ther 1985;37(4):402-406. 13. Segredo V, Caldwell JE, Matthay MA, et al: Persistent paralysis in critically ill patients after long-

term administration of vecuronium. N Engl J Med 1992;327:524-528.
14. Haynes SR, Morton NS. Prolonged neuromuscular blockade with vecuronium in a neonate with renal failure. Anaesthesia 1990;45:743-745.
15. Playfor S, Jenkins I, Boyles C, et al. Consensus guidelines for sustained neuromuscular blockade in critically ill children. Paediatr Anaesth 2007;17:881–7.
16. Hodges UM. Vecuronium infusion requirements in paediatric patients in intensive care units: the use of acceleromyography. Br J Anaesth 1996;76:23–8.
17. Johnson PN, Miller J, Gormley AK. Continuous-Infusion Neuromuscular Blocking Agents in Critically Ill Neonates and Children. Pharmacotherapy: The Journal of Human Pharmacology and Drug Therapy. 2011 Jun 1;31(6):609-20.
18. Micromedex solutions. Accessed on 13 December 2016.
19. Australian Injectable Drugs Handbook. 16th Edition. Accessed on 28 February 2017.
20. McEvoy CI, Sardesai S, Schilling D, Durand M. Acute effects of vecuronium on pulmonary function and hypoxemic episodes in preterm infants. Pediatrics International. 2007 Oct 1;49(5):631-6.
21. Eldadah MK, Newth CJ. Vecuronium by continuous infusion for neuromuscular blockade in infants and children. Critical care medicine. 1989 Oct 1;17(10):989-92

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