Drug Guideline  Vecuronium

Summary: Vecuronium is a nondepolarising neuromuscular blocking agent.

Approved by:  ICU Medical Director

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Replaces Existing Drug Guideline:  Vecuronium, September 2004

Previous Review Dates:  2002, 2004

1. Introduction contains:

The risk addressed by this drug guideline:

Patient safety

The Aims / Expected Outcome of this drug guideline:

Vecuronium will be administered safely and appropriately with minimal adverse effects.

Related Policies

- C3.00 Drug prescribing
- C3.01 Drug administration
- C3.01 Administration of IV Medications
- Nerve Stimulator Guideline

2. Policy Statement

- All care provided within Liverpool Hospital will be in accordance with infection prevention/control, manual handling and minimisation and management of aggression guidelines.
- Medications are to be prescribed and signed by a medical officer/authorised nurse practitioner (NP) unless required during an emergency.
- All drugs administered during an emergency (under the direction of a medical officer/authorised nurse practitioner) are to be documented during the event, then prescribed and signed following the event.
- Medications are to be given at the time prescribed (as close to the time as is possible when multiple drugs require ‘same time’ administration and, when the nurse is caring for more than one patient, recognition is given to a possible short delay to administration – antibiotics and other lifesaving drugs are to be prioritised) and are to be signed by the administering nurse.
- Parenteral medication prescriptions and the drug are to be checked with a second registered or endorsed enrolled nurse prior to administration. The “rights of drug administration” must be followed: right: patient, drug, dose, route,
administration, time, reason for the drug, documentation, education and evaluation/outcome.

- Adverse drug reactions are to be documented and reported to a medical officer.
- Medication errors are to be reported using the hospital electronic reporting system: IIMS.
- Guidelines are for adult patients unless otherwise stated.
- Patients are to receive concurrent sedation/anaesthesia when a neuromuscular blocking agent is in use, unless their neurological state does not require it.
- Paralysis is preferably maintained using bolus doses of a neuromuscular blocker as infusions increase adverse effects.
- A nerve stimulator must be used for determining on-going neuromuscular blockade; with the aim of achieving 2 finger twitches with ‘train-of-four’ assessment. Refer to the Nerve Stimulation Guideline or the Appendix at the end of this guideline.

3. Guideline

Actions\(^1\)

- Vecuronium is a non-depolarising neuromuscular blocker.
- Vecuronium competes for cholinergic receptors at the motor end plate. It competitively displaces acetylcholine from receptors on the motor end plate, thereby producing neuromuscular blockade.
- Vecuronium acts within 2 to 4 minutes and skeletal muscle relaxation lasts approximately 20 - 40 minutes.

Indications\(^1,2,5\)

- For use only in patients about to be intubated and ventilated or who are currently mechanically ventilated with a mandatory breath rate.
- Skeletal muscle relaxation for an extended period.
- Facilitate compliance with mechanical ventilation by preventing respiratory dysynchrony. Muscle paralysis may also reduce oxygen consumption by decreasing the work of breathing.
- Induction for intubation when suxamethonium is contraindicated.

Contraindications\(^1,2\)

- Absence of equipment and personnel experienced in performing intubation and ventilation.
- Hypersensitivity to vecuronium or other neuromuscular blocking agents.

Precautions

- Ensure the patient is receiving adequate analgesia and sedation.
- Hypothermia – prolonged paralysis may occur.
- Use with extreme caution in patients with neuromuscular disease such as myasthenia gravis.
- Use with caution in patients with muscular dystrophy.
- Following prolonged use in intensive care patients, prolonged paralysis and muscle weakness may occur.

Significant Interactions

- Suxamethonium.
- Aminoglycosides potentiate neuromuscular blockade.
- Increased effect with high doses of thiopentone, ketamine, fentanyl, and propofol.
- Increased effect with prior administration of magnesium, lithium, quinidine, tetracycline antibiotics, diuretics, beta-adrenergic blocking agents, thiamine,
MAOIs, protamine, alpha-adrenergic blocking agents, metronidazole, verapamil and dantrolene.

- Administration may also result in high levels of magnesium, low pH, renal/hepatic failure and low serum potassium, calcium and sodium.
- Decreased effect with prior chronic administration of corticosteroids, phenytoin or carbamazepine; noradrenaline, theophylline and calcium chloride.

**Adverse Effects**
- Anaphylaxis (rare).
- Tachycardia and hypotension.
- Tachycardia and hypertension with inadequate sedation.
- Prolonged paralysis and/or skeletal muscle weakness have been reported after long-term use. The term 'critical care polyneuropathy' has been coined to describe this syndrome.

**Presentation**
Vecuronium 10mg vial (powder that needs to be reconstituted with sterile water for injection.

**Administration Guidelines**
- Prepare for intubation and mechanical ventilation (Need to select a mode of ventilation with a mandatory respiratory rate on ventilator settings)
- Always induce sedation prior to administration of vecuronium.
- Dilute 10mg vecuronium with 10mL sterile water.
- Administer 0.1mg/kg (eg: 70 kg patient = 0.1 x 70 = 7mg) as an IV bolus and flush the IV line well.
- Assess effectiveness of muscular blockade using the nerve stimulator.

**IV Infusion**
- Dilute 50mg vecuronium with 10mL sterile water (provided as diluent) and further dilute with sterile 0.9% sodium chloride to a total volume of 50mL for administration via syringe driver.
- Final concentration is **1mg/mL**
- Administer 2 - 4mg bolus, observe blood pressure, avoid hypotension.
- Then titrate infusion at 0.05 – 0.1mL/kg/hr (50 – 100 micrograms/kg/hour) to achieve 2 twitches on Train of Four using a peripheral nerve stimulator (refer to Appendix 1).
- Assess neuromuscular blockade every 1 hour to ensure adequate blockade.

**Clinical Considerations**
- All patients receiving neuromuscular blockade with vecuronium must concurrently also receive analgesia and sedation.
- Reversal of the drug may be achieved with neostigmine and atropine.
- The time to onset of paralysis decreases and the duration of maximum effect increases with increasing vecuronium doses.
- When determining degree of paralysis using the nerve stimulator, 2 finger twitches on “Train of Four” is regarded as adequate neuromuscular blockade.
- Vecuronium has no known effect on consciousness, the pain threshold or cerebration.

4. **Performance Measures**
All incidents are documented using the hospital electronic reporting system: IIMS and managed appropriately by the NUM and staff as directed.

5. **References / Links**
Appendix 1 Peripheral Nerve Stimulator

The neuromuscular blockade is assessed by using a nerve stimulator. The peripheral nerve stimulator (PNS) is used to monitor impulse transmission across the neuromuscular junction. This allows assessment of the depth of neuromuscular blockade (NMB).

Indications for Use
All patients on the Intensive Care Unit who are receiving muscle relaxants by infusion should have the depth of neuromuscular blockade formally assessed at least 2nd hourly by peripheral nerve stimulation. They may be given a scheduled “drug holiday” (ie cessation of NMB until movement and deep tendon reflexes return, normally once a day).

“Train of Four” – this term describes four “twitches” delivered 0.5 sec apart. Because these stimuli are delivered so closely together, there is a fade in muscular response when neuromuscular blocking agents have been given.

Procedure.
1. **Position two surface electrodes** (ECG electrodes suffice) over the ulnar aspect of the patient’s forearm 2-3cm apart. This ensures that the nerve is stimulated and avoids direct electrical stimulation of the muscle. Connect to the leads marked “proximal” (red, +ve) and “distal” (black, -ve).
2. Turn unit on (and test battery if appropriate)

3. **Select current output** (20-40mA is usually sufficient, although 50-80mA may be necessary in oedematous or obese patients). You should be aware that nerve stimulation can be painful, and only the lowest output necessary should be selected.

4. **Press “Train of 4”/”TOF”** whilst carefully feeling the patient’s thumb. Stimulation of the ulnar nerve results in contraction of the adductor pollicis brevis muscle, resulting in twitching (flexion) of the thumb.

5. With **“ideal” neuromuscular blockade** using a NMB infusion, the rate should be adjusted so that only **one or two twitches of a TOF** are felt. Reassessment of the depth of blockade should be made 10-15 minutes following any rate change.

6. With **“intense” neuromuscular blockade**, there will be **no obvious twitch**. In such circumstances, the neuromuscular infusion should be decreased and the patient reassessed in 30-60 minutes. If in doubt, the test may be repeated with either an increased output or following a tetanic stimulation. The infusion rate is titrated to achieve 1-2 twitches. Decrease the infusion rate further if the return of one to two twitches has taken >60 minutes.

7. If on initial testing there is **normal twitch strength**, the patient is **inadequately blocked** at the neuromuscular junction, and the infusion will need to be increased (+/- following bolus).