NEUROMUSCULAR BLOCKADE

1. Purpose of document

1) To describe the appropriate use of neuromuscular blocking agents in DCCM
2) To outline other useful information relating to neuromuscular blockade including indications, basic pharmacology, risks, reversal agents and monitoring

2. Responsibility

All medical and nursing staff providing care and treatment for patients requiring neuromuscular blockade in DCCM

3. Document management principles and goals

Neuromuscular blocking agents are used fairly commonly in the intensive care setting to provide safer conditions for the management of ventilated patients in a variety of circumstances (outlined in Indications below) by preventing patient movement. However, they have significant risks which can be mitigated with appropriate usage, and understanding of basic pharmacology, side effects, reversal agents and monitoring

4. Indications

All patients to be given neuromuscular blockade should have a secure airway (or use of blockade should be to secure the airway), be mechanically ventilated until no longer paralysed and have appropriate sedation to prevent awareness and the risk of post-traumatic stress

Possible indications for neuromuscular blockade:

- airway manipulation (i.e. intubation)
- high risk secured airways
- transport (i.e. Intra-hospital to OT or radiology)
- raised intracerebral pressure (ICP)
- severe respiratory failure
- prone ventilation
- ventilator dyssynchrony/splinting
- life threatening hyperthermia (i.e. T>40C)
- cooling therapy for TTM or high ICP
- other ventilated patients when Intensivist deems necessary for safety

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5. Pharmacology

Drug	Suxamethonium	Rocuronium	Vecuronium	Atracurium
DCCM use	**Intubation only**	**1st line agent for intubation**	**1st line agent for maintenance blockade**	**Consider use for pts with significant renal or hepatic dysfunction**
Onset (O) & Duration (D)	O: 30-60sec D: 3-10 min	O: 45-90sec D:30-50min	O: 2-3min D: 45-60 min	O: 1-2.5min D: 30-50min
Bolus dose	**1-2mg/kg** (usually 100-200mg IV)	**0.6-1.2 mg/kg** for intubation (usually 50-100mg IV)	**4-8mg** IV	**25-50mg** IV
Infusion dose (needs ToF monitoring)	Not used for infusions	10-50mg/h (0.3-0.6mg/kg/h)	0.04-0.08 mg/kg/h	10-50mg/h (0.3-0.6mg/kg/h)
Reversal agent	Nil but short duration	Sugammadex 4-16mg/kg (available in East end Imprest)	Sugammadex 4-16mg/kg (available in East end Imprest)	Neostigmine + glycopyrollate 2.5mg/0.4mg (only with twitches on TOF)
Other notes	Lots of side effects including: allergy, muscle pains, hyperkalaemia, increased IOP/ICP	High dose for intubation for fastest onset.	Lower anaphylaxis incidence compared to other agents	Temperature dependent metabolism, therefore may need high doses with fever

6. Risks and side effects

Consequences of neuromuscular blockade

- Awareness and post-traumatic stress disorder if inadequate sedation
- Inability to neurologically assess or recognize seizures
- Prolonged paralysis if infusion inadequately monitored and with some drug interactions or hypothermia
- Loss of airway and apnoea can be life threatening if not continually monitored and ventilated via a secure airway
- Ventilation difficulties can occur due to loss of respiratory effort and change from negative to positive pressure dynamic

Side effects of neuromuscular blockers

- **Suxamethonium**: hyperkalaemia (particularly with burns, spinal cord injury or neuromuscular conditions and other denervation states), malignant hyperthermia, increased intraocular pressure, increased intra-gastric pressure, bradyarrhythmia, muscle pains.
- **Atracurium**: Can get histamine release and associated hypotension with rapid bolus, tachycardia and bronchospasm can occur
- **Critical illness weakness** associated with prolonged infusions

Allergy

- Most common with Suxamethonium and Rocuronium

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7. Reversal of neuromuscular blockade

Generally reversal is not required and waiting 2hrs for neuromuscular blockade to wear off before testing with TOF monitor and then desedating once 4 full twitches are observed is acceptable.

Non depolarising neuromuscular blocking agents can be reversed with the following agents:

- **Sugammadex** – Causes extremely rapid reversal of the steroid based drugs (Rocuronium and Vecuronium) at doses of 2-8mg/kg. Give 200mg ampoule, then assess for whether more required.
- **Neostigmine/Glycopyrollate** – This is not immediate for deeply paralysed patients and requires twitches on TOF monitoring to work. Give 2.5mg Neostigmine and 0.4mg glycopyrollate. Rarely required or used in the ICU setting for reversal of neuromuscular blockade.

8. Monitoring

See "*DCCM – Train-of-Four to Monitor Neuromuscular Blockade and*" policy for further information.

Train-of-Four count monitoring via peripheral nerve stimulator is recommended every 4 hours for all patients on maintenance neuromuscular blockade.

Generally, the target is for 1-2 twitches for adequate neuromuscular blockade.

All patients should have 4 twitches **of equal power** before they are de-sedated to prevent residual paralysis.