

## Non-depolarizing Neuromuscular Blocking Agents

Based on Ottawa monographs (2009)\* differences/similarities among the non-depolarizing neuromuscular blocking agents:

### Indication:

- All have same indications of facilitation of endotracheal intubation and skeletal muscle relaxation during surgery or mechanical ventilation
  - **Rocuronium** – also includes facilitation of rapid sequence endotracheal intubation

### Administration:

- IV direct: MD trained in anesthesiology; RN can give reinforcing doses. Ventilator support, cardiac monitoring.
  - **Atracurium** – administer undiluted over 30-60 seconds
  - **Cisatracurium** - administer undiluted over 5-10 second
  - **Pancuronium** - administer undiluted over at least 60 seconds
  - **Rocuronium** - administer undiluted or diluted in SWFI over 5-15 seconds
  - **Vecuronium** – **Reconstitute each 10 mg vial with 10 ml bacteriostatic WFI, NS, D5W or SWFI to obtain 1 mg/ml solution**
    - undiluted over 60-120 seconds
- **Infusion:** Ventilator support, cardiac monitoring.
  - **Atracurium (chamber)** – dilute to final of 0.2 mg/ml or 0.5 mg/ml. **DO NOT GIVE IM**
  - **Cisatracurium** - dilute to final of 0.1 mg/ml or 0.4 mg/ml in D5W or NS
  - **Pancuronium (chamber)** – dilute in compatible solution; titrate rate to patient response
  - **Rocuronium** - dilute in compatible solution to 0.5 mg/ml or 2 mg/ml
  - **Vecuronium** – further dilute in D5W, NS, RL or D5W-NS to 0.1-0.2 mg/ml

### Potential Administration Hazards

- CV
  - bradycardia (A, C)
  - tachycardia(A, P,R)
  - hypotension (A,C)
  - transient rise in BP (P)
  - arrhythmias (P-transient, R )

- abnormal ECG (R )
  - mild change in HR (V)
  - change in systemic vascular resistance (V)
  - change in cardiac index (V)
  - change in BP (V)
- Skin reactions
  - flushing (A,C)
  - erythema(A)
  - hives (A)
  - rash (C, P,R)
- Salivation if no anticholinergic premedication (P)
- Pulmonary
  - wheezing (A)
  - bronchospasm (A, C)
- Injection site
  - Pain(P)
  - edema (R )
- Antidote: anticholinesterase agents such as neostigmine, edrophonium or pyridostigmine, in conjunction with an anticholinergic agent such as atropine or glycopyrrolate (A,C, P)
- Histamine release unlikely following usual doses (R ,V)

## Dosage

- See specific monographs for doses
- Mentions:
  - **Atracurium**
    - different doses if patient has been administered isoflurane/enflurane/sevoflurane/desflurane compared to halothane/following succinylcholine/ patients with CV disease/ patients with allergies (histamine release)
  - Pancuronium
    - Dose for endotracheal intubation included
  - Rocuronium
    - Dose for endotracheal intubation included
    - Dose for rapid sequence intubation included

**Miscellaneous**

**Atracurium** – produces max N<sub>M</sub> blockade within 3-5 minutes and lasts about 20-35 minutes

**Cisatracurium** – product is hypotonic – do not administer into line of blood transfusion.

**Pancuronium** – onset 3 minutes; duration 30-45 minutes

-increased duration and intensity of effect when used with some inhalation anesthetics

-caution in patients with myasthenia gravis, debilitated states, renal impairment and hepatic insufficiency

-effect potentiated by hypokalemia and hypermagnesemia

-safe for use in malignant hyperthermia

**Rocuronium** – onset 1 minute; duration 30 minutes (to 25% recovery) after 0.6 mg/kg dose

**Vecuronium** – onset 2.5-3 minutes; duration 25-30 minutes

\*Bedard M, Massicotte A, Prasad S, editors. The Ottawa Hospital Parenteral Drug Therapy Manual. 13<sup>th</sup> ed. Ottawa; 2009.

Information collated by Carmen Bell, SDIS Drug Information Consultant, May 24, 2012

**Select Tables**

<b>Table 30-9 Nondepolarizing Neuromuscular Paralytic Agents</b>				
<b>Agent</b>	<b>Adult Intubating IV Dose</b>	<b>Onset</b>	<b>Duration</b>	<b>Comments</b>
<a href="#">Rocuronium</a> (intermediate/long)	1 milligram/kg	1–3 min	30–45 min	Tachycardia. Longer duration of action makes it a second choice to <a href="#">succinylcholine</a> . Use if <a href="#">succinylcholine</a> contraindicated. <sup>15</sup>
<a href="#">Vecuronium</a> (intermediate/long)	0.08–0.15 milligram/kg	2–4 min	25–40 min	Prolonged recovery time in obese or elderly, or if there is hepatorenal dysfunction.
	0.15–0.28 milligram/kg (high-dose protocol)		60–120 min	
<a href="#">Atracurium</a> (intermediate)	0.4–0.5 milligram/kg	2–3 min	25–45 min	Hypotension. Histamine release. Bronchospasm.

Visser RJ, Danzl DF. Chapter 30. Tracheal Intubation and Mechanical Ventilation. In: Tintinalli JE, Kelen GD, Stapczynski JS, eds. Tintinalli's Emergency Medicine: A Comprehensive Study Guide. 7th ed. New York: McGraw-Hill; 2011. <http://www.accessemergencymedicine.com/content.aspx?aID=6369632>. Accessed March 25, 2012.

**Table 4-4. Selected Pharmacologic Properties of the Neuromuscular Relaxants**

Agent	Intubation dose (mg/kg)	Average intubating time (min)	Clinical duration (min)	Comments
<a href="#">Succinylcholine</a>	0.6–1.5	1	4–6	Agent used for rapid sequence intubation. <sup>1,2</sup> Associated with side effects such as exaggerated hyperkalemia in susceptible patients (> 24 hours after major burns and trauma, crush injury, denervation, prolonged immobilization, paraplegia, hemiplegia, muscular dystrophy) and malignant hyperthermia. Elevates intraocular, intracranial, and intragastric pressures.
<a href="#">Rocuronium</a>	0.6–1.2	0.7–1.1	31–67	An alternative to <a href="#">succinylcholine</a> provided there is no anticipated difficulty in intubation. <sup>4</sup>
Mivacurium	0.15–0.25	1.5–2.5	16–23	Degraded by plasma cholinesterase. Releases histamine.
<a href="#">Vecuronium</a>	0.08–0.10	2.5–3.0	25–40	Cardiovascular effects unlikely. Alternative to <a href="#">succinylcholine</a> .
<a href="#">Cisatracurium</a>	0.15–0.20	1.5–2.0	55–65	Stereoisomer of <a href="#">atracurium</a> . No cardiovascular effects. Organ-independent elimination.
<a href="#">Atracurium</a>	0.4–0.5	2.0–2.5	35–45	Elimination independent of liver and kidney. Releases histamine.
<a href="#">Pancuronium</a>	0.06–0.10	2.0–3.0	56–100	Tachycardia and sympathetic nervous system activation.

Induction. In: Reichman EF, Simon RR, eds. *Emergency Medicine Procedures*. New York: McGraw-Hill; 2004.  
<http://www.accessemergencymedicine.com/content.aspx?aID=50084>. Accessed March 25, 2012.

**Table 5-2. Rapid Sequence Induction Medications for Specific Patient Profiles**

Patient type	Premedication*	Induction and paralysis <sup>†</sup>
"Normal adult"	<a href="#">Vecuronium</a> (0.01 mg/kg)	<a href="#">Etomidate</a> (0.3 mg/kg) or <a href="#">propofol</a> (1–2.5 mg/kg) or <a href="#">thiopental</a> (3 mg/kg) and <a href="#">succinylcholine</a> (2 mg/kg)
"Normal child"	<a href="#">Vecuronium</a> (0.01 mg/kg) and <a href="#">atropine</a> (0.02 mg/kg, min dose 0.1 mg)	<a href="#">Thiopental</a> (5 mg/kg) and <a href="#">succinylcholine</a> (2 mg/kg)
Asthma, adult	<a href="#">Lidocaine</a> (1.5 mg/kg) and <a href="#">atropine</a> (0.5 mg)	<a href="#">Ketamine</a> (1–2 mg/kg) and <a href="#">succinylcholine</a> (2 mg/kg)
Asthma, child	<a href="#">Lidocaine</a> (1.5 mg/kg) and <a href="#">atropine</a> (0.02 mg, min 0.1 mg)	<a href="#">Ketamine</a> (1–2 mg/kg) and <a href="#">succinylcholine</a> (2 mg/kg)
Head injury, adult	<a href="#">Vecuronium</a> (0.01 mg/kg) and <a href="#">lidocaine</a> (1.5 mg/kg) and <a href="#">fentanyl</a> (3–5 µg/kg)	<a href="#">Etomidate</a> (0.3 mg/kg) and <a href="#">succinylcholine</a> (2 mg/kg)
Head injury, child	<a href="#">Vecuronium</a> (0.01 mg/kg) and <a href="#">atropine</a> (0.02 mg/kg, min 0.1 mg) and <a href="#">lidocaine</a> (1.5 mg/kg) and <a href="#">fentanyl</a> (3–5 µg/kg)	<a href="#">Thiopental</a> (5 mg/kg) and <a href="#">succinylcholine</a> (2 mg/kg)
Head injury, adult, hypotensive	<a href="#">Vecuronium</a> (0.01 mg/kg) and <a href="#">fentanyl</a> (3 µg/kg) and <a href="#">lidocaine</a> (1.5 mg/kg)	<a href="#">Etomidate</a> (0.2 mg/kg) and <a href="#">succinylcholine</a> (1.5 mg/kg)
Head injury, child, hypotensive	<a href="#">Vecuronium</a> (0.01 mg/kg) and <a href="#">atropine</a> (0.02 mg/kg, min 0.1 mg) and <a href="#">lidocaine</a> (1.5 mg/kg) and <a href="#">fentanyl</a> (2–3 µg/kg)	<a href="#">Midazolam</a> (0.15 mg/kg) or <a href="#">etomidate</a> (0.3 mg/kg) and <a href="#">succinylcholine</a> (2 mg/kg)
Hyperkalemia or renal failure, adult	None	<a href="#">Etomidate</a> (0.3 mg/kg) or <a href="#">propofol</a> (1.0–2.5 mg/kg) or <a href="#">thiopental</a> (3 mg/kg) and <a href="#">rocuronium</a> (0.6 mg/kg) or <a href="#">vecuronium</a> (0.01 mg/kg)

**Table 5-2. Rapid Sequence Induction Medications for Specific Patient Profiles**

Patient type	Premedication*	Induction and paralysis <sup>†</sup>
Hyperkalemia or renal failure, child	None	<a href="#">Thiopental</a> (5 mg/kg) and <a href="#">rocuronium</a> (0.6 mg/kg) or <a href="#">vecuronium</a> (0.01 mg/kg)
Status epilepticus, adult	None	<a href="#">Thiopental</a> (3 mg/kg) and <a href="#">succinylcholine</a> (2 mg/kg)
Status epilepticus, child	None	<a href="#">Thiopental</a> (5 mg/kg) and <a href="#">succinylcholine</a> (2 mg/kg)
Pregnancy	<a href="#">Atropine</a> (0.5 mg)	<a href="#">Ketamine</a> (1–2 mg/kg) and <a href="#">rocuronium</a> (0.6 mg/kg) or <a href="#">vecuronium</a> (0.01 mg/kg)

Morocco M, Reichman EF. Chapter 5. Orotracheal Intubation. In: Reichman EF, Simon RR, eds. *Emergency Medicine Procedures*. New York: McGraw-Hill; 2004. <http://www.accessemergencymedicine.com/content.aspx?aID=50939>. Accessed March 25, 2012.

Tables collated by Carmen Bell, Drug Information Consultant; March 28, 2012