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_M 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. 13th ed. Ottawa; 2009.

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

Select Tables

Table 30-9 Nondepolarizing Neuromuscular Paralytic Agents

Agent	Adult Intubating IV Dose	Onset	Duration	Comments
Rocuronium (intermediate/long)	1 milligram/kg	1–3 min	30–45 min	Tachycardia. Longer duration of action makes it a second choice to succinylcholine. Use if succinylcholine contraindicated.[15]
Vecuronium (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	
Atracurium (intermediate)	0.4–0.5 milligram/kg	2–3 min	25–45 min	Hypotension. Histamine release. Bronchospasm.

Vissers 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**
Succinylcholine	0.6–1.5	1	4–6	Agent used for rapid sequence intubation.[1,2] Associated with side effects such as exaggerated hyperkalemia in susceptible patients (> 24 hours aftermajor burns and trauma, crush injury, denervation, prolonged immobilization, paraplegia, hemiplegia, muscular dystrophy) and malignant hyperthermia. Elevates intraocular, intracranial, and intragastric pressures.
Rocuronium	0.6–1.2	0.7–1.1	31–67	An alternative to succinylcholine provided there is no anticipated difficulty in intubation.[4]
Mivacurium	0.15–0.25	1.5–2.5	16–23	Degraded by plasma cholinesterase. Releases histamine.
Vecuronium	0.08–0.10	2.5–3.0	25–40	Cardiovascular effects unlikely. Alternative to succinylcholine.
Cisatracurium	0.15–0.20	1.5–2.0	55–65	Stereoisomer of atracurium. No cardiovascular effects. Organ-independent elimination.
Atracurium	0.4–0.5	2.0–2.5	35–45	Elimination independent of liver and kidney. Releases histamine.
Pancuronium	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†**
"Normal adult"	Vecuronium (0.01 mg/kg)	Etomidate (0.3 mg/kg) or propofol (1–2.5 mg/kg) or thiopental (3 mg/kg) and succinylcholine (2 mg/kg)
"Normal child"	Vecuronium (0.01 mg/kg) and atropine (0.02 mg/kg, min dose 0.1 mg)	Thiopental (5 mg/kg) and succinylcholine (2 mg/kg)
Asthma, adult	Lidocaine (1.5 mg/kg) and atropine (0.5 mg)	Ketamine (1–2 mg/kg) and succinylcholine (2 mg/kg)
Asthma, child	Lidocaine (1.5 mg/kg) and atropine (0.02 mg, min 0.1 mg)	Ketamine (1–2 mg/kg) and succinylcholine (2 mg/kg)
Head injury, adult	Vecuronium (0.01 mg/kg) and lidocaine (1.5 mg/kg) and fentanyl (3–5 µg/kg)	Etomidate (0.3 mg/kg) and succinylcholine (2 mg/kg)
Head injury, child	Vecuronium (0.01 mg/kg) and atropine (0.02 mg/kg, min 0.1 mg) and lidocaine (1.5 mg/kg) and fentanyl (3–5 µg/kg)	Thiopental (5 mg/kg) and succinylcholine (2 mg/kg)
Head injury, adult, hypotensive	Vecuronium (0.01 mg/kg) and fentanyl (3 µg/kg) and lidocaine (1.5 mg/kg)	Etomidate (0.2 mg/kg) and succinylcholine (1.5 mg/kg)
Head injury, child, hypotensive	Vecuronium (0.01 mg/kg) and atropine (0.02 mg/kg, min 0.1 mg) and lidocaine (1.5 mg/kg) and fentanyl (2–3 µg/kg)	Midazolam (0.15 mg/kg) or etomidate (0.3 mg/kg) and succinylcholine (2 mg/kg)
Hyperkalemia or renal failure, adult	None	Etomidate (0.3 mg/kg) or propofol (1.0–2.5 mg/kg) or thiopental (3 mg/kg) and rocuronium (0.6 mg/kg) or vecuronium (0.01 mg/kg)

Table 5-2. Rapid Sequence Induction Medications for Specific Patient Profiles		
Patient type	**Premedication***	**Induction and paralysis†**
Hyperkalemia or renal failure, child	None	Thiopental (5 mg/kg) and rocuronium (0.6 mg/kg) or vecuronium (0.01 mg/kg)
Status epilepticus, adult	None	Thiopental (3 mg/kg) and succinylcholine (2 mg/kg)
Status epilepticus, child	None	Thiopental (5 mg/kg) and succinylcholine (2 mg/kg)
Pregnancy	Atropine (0.5 mg)	Ketamine (1–2 mg/kg) and rocuronium (0.6 mg/kg) or vecuronium (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