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)

  o Skin reactions
    - flushing (A,C)
    - erythema(A)
    - hives (A)
    - rash (C, P,R)

  o Salivation if no anticholinergic premedication (P)
  o Pulmonary
    - wheezing (A)
    - bronchospasm (A, C)
  o Injection site
    - Pain(P)
    - edema (R)

  o Antidote: anticholinesterase agents such as neostigmine, edrophonium or pyridostigmine, in conjunction with an anticholinergic agent such as atropine or glycopyrrolate (A,C, P)
  o Histamine release unlikely following usual doses (R,V)

**Dosage**

  o See specific monographs for doses
  o Mentions:
    o **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)
    o Pancuronium
      - Dose for endotracheal intubation included
    o Rocuronium
      - Dose for endotracheal intubation included
      - Dose for rapid sequence intubation included
**Miscellaneous**

**Atracurium** – produces max N\textsubscript{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


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

### Select Tables

#### Table 30-9 Nondepolarizing Neuromuscular Paralytic Agents

<table>
<thead>
<tr>
<th>Agent</th>
<th>Adult Intubating IV Dose</th>
<th>Onset</th>
<th>Duration</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rocuronium</strong> (intermediate/long)</td>
<td>1 milligram/kg</td>
<td>1–3 min</td>
<td>30–45 min</td>
<td>Tachycardia. Longer duration of action makes it a second choice to succinylcholine. Use if succinylcholine contraindicated.\textsuperscript{15}</td>
</tr>
<tr>
<td><strong>Vecuronium</strong> (intermediate/long)</td>
<td>0.08–0.15 milligram/kg</td>
<td>2–4 min</td>
<td>25–40 min</td>
<td>Prolonged recovery time in obese or elderly, or if there is hepatorenal dysfunction.</td>
</tr>
<tr>
<td></td>
<td>0.15–0.28 milligram/kg (high-dose protocol)</td>
<td></td>
<td>60–120 min</td>
<td></td>
</tr>
<tr>
<td><strong>Atracurium</strong> (intermediate)</td>
<td>0.4–0.5 milligram/kg</td>
<td>2–3 min</td>
<td>25–45 min</td>
<td>Hypotension. Histamine release. Bronchospasm.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Agent</th>
<th>Intubation dose (mg/kg)</th>
<th>Average intubating time (min)</th>
<th>Clinical duration (min)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Succinylcholine</td>
<td>0.6–1.5</td>
<td>1</td>
<td>4–6</td>
<td>Agent used for rapid sequence intubation.²³ Associated with side effects such as exaggerated hyperkalemia in susceptible patients (&gt; 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.</td>
</tr>
<tr>
<td>Rocuronium</td>
<td>0.6–1.2</td>
<td>0.7–1.1</td>
<td>31–67</td>
<td>An alternative to succinylcholine provided there is no anticipated difficulty in intubation.⁴</td>
</tr>
<tr>
<td>Mivacurium</td>
<td>0.15–0.25</td>
<td>1.5–2.5</td>
<td>16–23</td>
<td>Degraded by plasma cholinesterase. Releases histamine.</td>
</tr>
<tr>
<td>Vecuronium</td>
<td>0.08–0.10</td>
<td>2.5–3.0</td>
<td>25–40</td>
<td>Cardiovascular effects unlikely. Alternative to succinylcholine.</td>
</tr>
<tr>
<td>Cisatracurium</td>
<td>0.15–0.20</td>
<td>1.5–2.0</td>
<td>55–65</td>
<td>Stereoisomer of atracurium. No cardiovascular effects. Organ-independent elimination.</td>
</tr>
<tr>
<td>Atracurium</td>
<td>0.4–0.5</td>
<td>2.0–2.5</td>
<td>35–45</td>
<td>Elimination independent of liver and kidney. Releases histamine.</td>
</tr>
<tr>
<td>Pancuronium</td>
<td>0.06–0.10</td>
<td>2.0–3.0</td>
<td>56–100</td>
<td>Tachycardia and sympathetic nervous system activation.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Patient type</th>
<th>Premedication*</th>
<th>Induction and paralysis†</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Normal adult&quot;</td>
<td>Vecuronium (0.01 mg/kg)</td>
<td>Etomidate (0.3 mg/kg) or propofol (1–2.5 mg/kg) or thiopental (3 mg/kg) and succinylcholine (2 mg/kg)</td>
</tr>
<tr>
<td>&quot;Normal child&quot;</td>
<td>Vecuronium (0.01 mg/kg) and atropine (0.02 mg/kg, min dose 0.1 mg)</td>
<td>Thiopeptal (5 mg/kg) and succinylcholine (2 mg/kg)</td>
</tr>
<tr>
<td>Asthma, adult</td>
<td>Lidocaine (1.5 mg/kg) and atropine (0.5 mg)</td>
<td>Ketamine (1–2 mg/kg) and succinylcholine (2 mg/kg)</td>
</tr>
<tr>
<td>Asthma, child</td>
<td>Lidocaine (1.5 mg/kg) and atropine (0.02 mg, min 0.1 mg)</td>
<td>Ketamine (1–2 mg/kg) and succinylcholine (2 mg/kg)</td>
</tr>
<tr>
<td>Head injury, adult</td>
<td>Vecuronium (0.01 mg/kg) and lidocaine (1.5 mg/kg) and fentanyl (3–5 μg/kg)</td>
<td>Etomidate (0.3 mg/kg) and succinylcholine (2 mg/kg)</td>
</tr>
<tr>
<td>Head injury, child</td>
<td>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)</td>
<td>Thiopeptal (5 mg/kg) and succinylcholine (2 mg/kg)</td>
</tr>
<tr>
<td>Head injury, adult, hypotensive</td>
<td>Vecuronium (0.01 mg/kg) and fentanyl (3 μg/kg) and lidocaine (1.5 mg/kg)</td>
<td>Etomidate (0.2 mg/kg) and succinylcholine (1.5 mg/kg)</td>
</tr>
<tr>
<td>Head injury, child, hypotensive</td>
<td>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)</td>
<td>Midazolam (0.15 mg/kg) or etomidate (0.3 mg/kg) and succinylcholine (2 mg/kg)</td>
</tr>
<tr>
<td>Hyperkalemia or renal failure, adult</td>
<td>None</td>
<td>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)</td>
</tr>
</tbody>
</table>
### Table 5-2. Rapid Sequence Induction Medications for Specific Patient Profiles

<table>
<thead>
<tr>
<th>Patient type</th>
<th>Premedication*</th>
<th>Induction and paralysis†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyperkalemia or renal failure, child</td>
<td>None</td>
<td>Thiopental (5 mg/kg) and rocuronium (0.6 mg/kg) or vecuronium (0.01 mg/kg)</td>
</tr>
<tr>
<td>Status epilepticus, adult</td>
<td>None</td>
<td>Thiopental (3 mg/kg) and succinylcholine (2 mg/kg)</td>
</tr>
<tr>
<td>Status epilepticus, child</td>
<td>None</td>
<td>Thiopental (5 mg/kg) and succinylcholine (2 mg/kg)</td>
</tr>
<tr>
<td>Pregnancy</td>
<td><strong>Atropine</strong> (0.5 mg)</td>
<td>Ketamine (1–2 mg/kg) and rocuronium (0.6 mg/kg) or vecuronium (0.01 mg/kg)</td>
</tr>
</tbody>
</table>


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