Neuromuscular Blocking Agents Metabolism & Elimination

***CoreNotes* by Core Concepts Anesthesia Review, LLC**

What You Must Know

1. Succinylcholine (SCh) is metabolized by plasma cholinesterase (a.k.a. pseudocholinesterase, butyrylcholinesterase) to succinic acid, choline & succinylmonocholine.
    a. Succinylmonocholine retains minimal activity.
    b. Genetic variations can alter both the quantity and activity of plasma cholinesterase and greatly increase the duration of SCh.
2. Atracurium and cis-atracurium are benzylisoquinoline diesters that are able to degrade spontaneously through a mechanism known as the Hoffman elimination.
    a. The Hoffman elimination is temperature and pH dependent, such that elevation in either results in more rapid degradation of the drug.
    b. Degradation through the Hoffman Elimination produces laudanosine and pentamethylenediacrylate.
    c. Both drugs can also be metabolized by non-specific plasma esterases.
3. Vecuronium is quickly absorbed by the liver and mostly excreted in the bile as unchanged drug.
    a. Three metabolites of vecuronium exist: 3-desacetylvecuronium, 3,17-desacetylvecuronium & 17-desacetylvecuronium.
    b. 3-desacetylvecuronium has about one half of the blocking properties of vecuronium.
4. Rocuronium is rapidly removed from circulation by the liver and excreted unchanged in the bile and urine. Rocuronium has no active metabolites.
5. Pancuronium is largely excreted by the kidneys. However, pancuronium, like vecuronium, undergoes oxidative metabolism in the liver to produce 3-desacetylpancuronium, 3,17-desacetylpancuronium & 17-desacetylpancuronium.

SCh undergoes hydrolysis by plasma cholinesterase to produce succinic acid, choline and succinylmonocholine. However, SCh is not metabolized by true cholinesterase and termination of neuromuscular blockade occurs as SCh diffuses from the neuromuscular junction.

The benzylisoquinoline diesters, atracurium & cis-atracurium have two modes of elimination. Both drugs can spontaneously degrade through the Hoffman elimination, which is pH and temperature dependent. In addition, both drugs can undergo ester hydrolysis by non-specific plasma esterases.

Rocuronium, vecuronium and pancuronium are steroidal muscle relaxants. Both rocuronium and vecuronium undergo extensive elimination by the liver and the half-life of both drugs is prolonged in patients with hepatic disease. Pancuronium depends largely on renal elimination, although about 10% of the drug is metabolized by the liver.

Additional Reading:

Longnecker, DE, Brown, DL, Newman MF and Zapol, WM. *Anesthesiology*. New York: McGraw Hill, 2012: 496-505