

SUCCINYLCHOLINE “THE GOLD STANDARD”
FOR RAPID-SEQUENCE INDUCTION
OF ANESTHESIA

- Pro & Cons -

The neuromuscular effects of succinylcholine (SCh) were described¹ by Bovet 1949. The drug was introduced into clinical anesthesia in the United States by Foldes et al 1952, who stated that “the advantages of succinylcholine as a muscular relaxant in anesthesiology far outweighed its disadvantages”². Even today in the 6th decade of its use, SCh, despite complications, survived as the “gold standard” for rapid-sequence induction of anesthesia (RSI), against which other relaxants are compared³. The drug survived, despite the reported complications, because of the unique triad characterizing its neuromuscular block i.e. rapid onset, profound relaxation and short duration, which makes succinylcholine the drug of choice for rapid-sequence induction (RSI) of anesthesia in patients with full stomach, as well as the preferred relaxant for tracheal intubation in patients with a predicted difficult airway³⁻⁵.

This characteristic triad of succinylcholine neuromuscular block can be attributed to the rapid hydrolysis of SCh by the normal plasma cholinesterase, as well as to its depolarizing action. In addition, the low molecular weight of SCh, and its simple molecular configuration consisting of two acetylcholine molecules attached together may contribute to its rapid onset of action by allowing the drug to pass directly from the blood to the endplate receptors prior to equilibration in the extracellular fluid.

The hydrolysis of SCh by the normal plasma cholinesterase is very rapid, and the rate of hydrolysis is proportional to the substrate concentration. This rapid hydrolysis into succinylmonocholine and choline can allow us to use multiple ED95 doses (up to 5-10 ED95) which result in a very rapid onset of deep neuromuscular block, without a significant increase in the duration of action.

The depolarization mechanism of SCh can also contribute to the rapid onset of block since we need to activate only 10-25% of the endplate receptors in order to achieve depolarization block. In contrast, non depolarizing relaxants need to block 75-90% of the receptors (i.e. the safety margin) in order to produce nondepolarizing neuromuscular block. Also, SCh can relax the fast-contracting muscles such as the vocal cords and the masseters more than the nondepolarizing relaxants which relax the slow-contracting muscles more than the fast-contracting muscles. In addition, the action of SCh is actually endplate-muscular and not neuro-muscular block which can result in profound muscular relaxation⁶.

In conclusion, SCh stood the test of time as the “Gold Standard” relaxant for rapid-sequence induction of anesthesia because of its very rapid hydrolysis, its depolarizing mechanism of block, as well as to its simple and low molecular weight structure which can contribute to the triad characteristics of SCh block i.e. rapid onset, profound block and short duration of action. However, “there is no free dinner”. The characteristics contributing to the advantages of SCh as the “Gold Standard” for rapid sequence induction of anesthesia i.e. the very rapid hydrolysis and

its depolarizing action are the same factors that result in its side effects:

- I. The ultra-short action of SCh in the presence of normal plasma cholinesterase can change into a very prolonged block in the presence of homozygote atypical cholinesterase. This will be associated with gradual desensitization and change of block characteristics from depolarizing block (No tetanic fade and no post-tetanic facilitation) into phase II block (tetanic fade and post-tetanic facilitation).
- II. The depolarizing action of SCh can result in:
 1. Post operative myalgia
 2. Increase of intraocular pressure, intracranial pressure, intragastric pressure and intra abdominal pressure
- III. The autonomic effects of SCh can result following the initial dose in sympathomimetic side effects such as hypertension and tachycardia. In contrast, repeated doses of SCh may produce vagotonic bradycardia
- IV. In patients having neuromuscular disorders, depolarization by SCh can be complicated by serious hyperkalemia, rhabdomyolysis and

malignant hyperthermia⁷.

Now, is it time to say Good Bye Sux?!

It seems not yet, until we can find an alternative non-depolarizing relaxant having similar characteristics i.e. rapid onset, short duration and profound neuromuscular block. However, because of the complications that can follow administration of SCh, I recommend the following:

1. To avoid SCh whenever contraindicated e.g. in patients having neuromuscular disorders
2. To use SCh only whenever indicated: e.g RSI in patients with full stomach^{4,5,8}, and tracheal intubation in patients having predicted difficult airway. In addition, SCh as a single dose, may be indicated in procedures requiring profound relaxation for a short duration, such as electroconvulsive therapy, cardioversion, fracture setting³, and relief of laryngospasm. Also, SCh is the only relaxant which is effective following intramuscular injection.

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