Succinylcholine

Succinylcholine is a paralytic agent used for surgeries or short procedures, such as intubation. It works by binding at motor nicotinic acetylcholine receptors and keeping myocytes in a depolarized state. This prevents acetylcholine from binding to receptors and prevents muscle contraction. This drug has two phases of action in its mechanism. In phase I, this administered agent is non-reversible. Myocytes still have succinylcholine actively bound to motor-nicotinic receptors and there is a constant depolarized state. Patients often show fasciculations and held-contractions. In phase II, the receptors become sensitized and repolarize. They can only be aroused for action potential with larger amounts of acetylcholine, which is why neostigmine (an acetylcholinesterase inhibitor) can be used to help reverse paralysis in phase II. This paralytic agent can cause malignant hyperthermia in patients, and should not be used in patients in a hyperkalaemic state.



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Indications

Inducing Paralysis
Wheelchair
This drug is typically used in surgery or for short procedures. It can be used for patients in trauma care to help with intubation, or in those undergoing electroconvulsive therapy.

Mechanism of Action

Neuromuscular Blocking Drugs
Nerve-muscle Blocks
This drug is considered a neuromuscular blocking drug. It binds to the nicotinic acetylcholine receptor and keeps the receiving nerve stuck in a depolarized state.

Motor Nicotinic Receptor
Motor Cigarette Receptor
Succincylcholine exerts its action by binding to the motor nicotinic receptor, which typically only accepts endogenous acetylcholine.

ACh Receptor Agonist
A-seagull-cola Receptor Dragonist
This drug mimics acetylcholine at the nicotinic receptor, opening sodium channels and causing membrane depolarization.

Depolarization
D-polar-bear
Succinylcholine keeps cells in sustained depolarization and prevents muscle contraction. The endogenous ligand for this receptor, acetylcholine, is removed from the receptor in second. Succinylcholine, on the other hand, is bound for much longer time. This can be observed immediately after IV administration of this drug, as patients fasciculate (contract), and are unable to contract again, even after electrical stimulation.

Phases of Action

Phase I (Paralysis Non-reversible)
(1) Wand Phase (Wheelchair Locked)
Phase I of this drug is characterized by maintaining the muscle cell's membrane potential above the action potential threshold. The cells are kept in a depolarized state (as succinylcholine is bound to the receptor), as succinylcholine is not broken down quickly. This period of paralysis cannot be overcome, as there is nowhere for acetylcholine to bind.

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Phase II (Paralysis Reversible)

(2) Tutu Phase (Wheelchair Reversed and unlocked)

Phase II blocking of this drug is characterized by the cells being repolarized but blocked. The myocytes become sensitized to their receptor activity and eventually repolarize. ACh receptors are now available but are less sensitive to acetylcholine; they are desensitized. This paralysis is reversible, but needs a larger acetylcholine stimulus to cause contraction.

Neostigmine (Reversal Agent)

Neon-stick-man

Neostigmine is an acetylcholinesterase inhibitor and prevents the breakdown of acetylcholine in the plasma. This leads to an increase in acetylcholine concentration. It is often used to overcome the desensitization experience by paralyzed patients in Phase II block of succinylcholine.

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