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Anesthetic Pathology

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Review Article

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ABSTRACT

Anesthesia is an integral and important part of any major surgical procedure. With time and gained knowledge this term has become a sub discipline of medical science. Established medical tips are offered for native and general anesthesia. Numerous factors are vital throughout application of physiological condition protocol wherever patient's age, actual malady condition etc. ought to be thought of with care.

ANESTHESIA

Anesthetics are drugs that are generally used to generate anesthesia [1-3]. We've got totally different categories of anesthetics in apply corresponding to anesthetic, local, regional anesthetic. Some anesthetics like desflurane, cocaine, lidocaine, propaine, inert gas square measure few can be used for generate anesthesia to avoid pain and discomfort. These anesthetics result in reversible loss of sensation [4,5].

Despite the fact that the clinical world cannot cure each disorder, the management of pain to make sure patient comfort ought to be a goal. Cacaine is an oldest anesthetic in 1860 and it was extracted from the leaves of the Erythroxylon coca bush [6-8]. Sigmund Freud and Karl Koller have been the primary used anesthetic agents in 1884 for the prolongation of ophthalmologic processes [9,10].

Procaine, an artificial alternative to cocaine, wasn't developed till 1904. This Procaine is an ester anesthetic, generally metabolized in plasma and through hydrolysis releases PABA as metabolic product which is an allergen product [11,12]. Using of procaine and other ester-type anesthetic marketers was limited because of their extreme allergies. So in 1930s Tetracaine and some other ester-type anesthetics were developed [13,14]. Tetracaine is stronger than procaine, and it causes comparable hypersensitive reactions.

When Lofgren was developed local anesthetic (lidocaine) in 1943, then alternative classes of anesthetics were discovered [14-17]. This developed lidocaine is an amide spinoff of diethylaminoacetic acid, now not PABA; thus, it has the benefit of low allergic capabilities. In view that then, more than one amide-variety anesthetics were offered into scientific use. Moderate chemical changes to the compounds have imparted important traits, together with extended duration and efficiency [18-20], to each. These compounds present the healthcare professional extra picks, and anesthetics will also be thoroughly matched to special techniques.

General Anesthesia

To induce deep sleep the method which is used is General anesthesia. Loss of reversible consciousness can be induced by using these general anesthetics [21-23]. With the help of this method patient will go into deep sleep during the surgery and will not be aware of it.

When the patient receives medications for amnesia, analgesia, muscle paralysis, and sedation then condition produced is called general anesthesia [24-27]. The patient who is anesthetized feels himself that everything is in his

control. Surgical procedures that would inflict "unbearable pain which potentiate extreme physiologic exacerbations, and result in unpleasant memories" this condition can be tolerable by giving anesthesia [28-30].

Patient feels following conditions when given with combination of anesthetic agents during general anesthesia.

1. Even the patient is secondary to surgery or any other treatment he feels Unarousable pain.
2. He can't even remember what happened during his treatment (amnesia).
3. Because of muscle paralysis the patient was not able to maintain adequate airway protection and/or spontaneous ventilation.

Local Anesthesia

To avoid pain and discomfort during the surgical and medical procedures the method used is local anesthesia which is used to induce the anesthesia that involves numbing on a specific part of the body. Local anesthetics are safer to perform minor surgeries and in pain management to provide anesthesia [31-34].

Reversible regional loss of sensation is generally produced by these local anesthetics. By reducing pain these local anesthetics facilitates many surgical procedures. Delivery techniques include topical anesthesia [35,36], infiltrative anesthesia [37], ring blocks [38], and peripheral nerve blocks have broaden the clinical applicability of local anesthetics.

Pathophysiology

Before any discussions it is very important to know about the nerve conduction physiology in local anesthetics. Due to the propagation of electrical impulses, nerves transmit sensation occurs [39,40]; this electrical impulses propagation is achieved across the nerve cell wall, or axolemma by alternating the ion gradient.

The negative membrane potential of -70 mV is indicates that, the nerve is in normal resting state. This resting potential is determined by 2 major ions, Na+ and K+ relative membrane permeability and concentration gradients of these major ions (also known as leak currents) and these concentration gradients are maintained by the sodium/potassium ATP pump process. This Na+/K ATP pump process accomplished by transporting potassium ions into the cell and sodium ions out of the cell. So the concentration gradient which was created by this active transport favors the extracellular diffusion of potassium ions. Because the process of nerve membrane is impermeable to sodium ions and permeable to potassium ions, condition happens is 95% of the ionic leak in excitable cells is caused by K+ ions in the form of an outward flux, and leads to the negative resting potential of the nerve. The reason for leaking of this K+ currents was believed to be recently identified 2-pore domain potassium (K2P) channels [41-45].

Impulse propagation progresses and depolarization of the nerve occurs when the nerve is stimulated. Initially, through the nerve cell membrane sodium ions are gradually enter the cell and this entry of sodium ions causes the trans-membrane electric potential to increase from the resting potential [46-48]. Reaching of approximate potential -55 mV indicates the condition called threshold level and once it happens, rapid influx of sodium ions increases and in the cell membrane sodium channels becomes activated, so permeability of sodium ions increases and the nerve membrane is depolarized to a level of +35 mV or more [49,50].

Once the above process (membrane depolarization) is complete, the permeability of potassium ions into the cell is increases and permeability of sodium ions across the membrane becomes impermeable again [51-53]. Because of this process negative resting membrane potential can be bring back by restoring the excess of extracellular sodium and intracellular potassium. The changes in potential of nerve cell membrane are known as action potential.

MECHANISM OF ACTION

By interfering with Na+ and K+ currents local anesthetics can inhibit depolarization of the nerve membrane. Here threshold level is never reached so the action potential will not be propagated [57-59].

The exact mechanism of retarding influx of sodium ions into the cell by using local anesthetics is unknown. So to make it clear 2 theories have been proposed:

Coming to 1st theory called membrane expansion theory. That postulates that cell membrane absorbs local anesthetics and gets expanded, that leads to sodium channel narrowing. This hypothesis has given way to the specific receptor theory [60-62]. Diffusion of local anesthetics across the cell membrane and binding to a specific receptor at the opening of the voltage-gated sodium channel was proposed by this theory. When the excitation rate of the neuron increases then the affinity of local anesthetics to the voltage-gated Na+ channel is also increases markedly. This binding to voltage-gated Na+ channel causes alterations in the function/structure of the Na+ channel and inhibits its movement.

Coming to 2nd theory, Blockade of leak K+ currents by local anesthetics is now also believed to contribute to conduction block by reducing the ability of the channels to set the membrane potential [63-65].

Nerve fibers are classified into three types on basis of their diameter. Type A fibers are largest fibers and they are responsible for pressure conducting and motor sensations [66,67]. Type B fibers are moderate in size and myelinated. Type C fibers are small, unmyelinated and they transmit pain and temperature sensations. When compared to type A fibers anesthetics can block type C fibers more easily. Because of this unblocked type A fibers patients still feel pressure and have mobility even he has blocked pain sensation [68-70].

Coming to structure of local anesthetics almost all local anesthetics have similarity in their chemical structure, which composed of 3 components: an amine group, intermediate chain, an aromatic portion (Figure 1). The aromatic portion consist of a benzene ring is lipophilic and the amine portion is responsible for its hydrophilic properties [71-75]. For any anesthetic degree of lipid solubility is an important property because its diffusion across the highly lipophilic nerve membrane is determined by this lipid solubility nature only. So this lipophilicity nature of the anesthetic's is directly related to its efficacy [76-80].

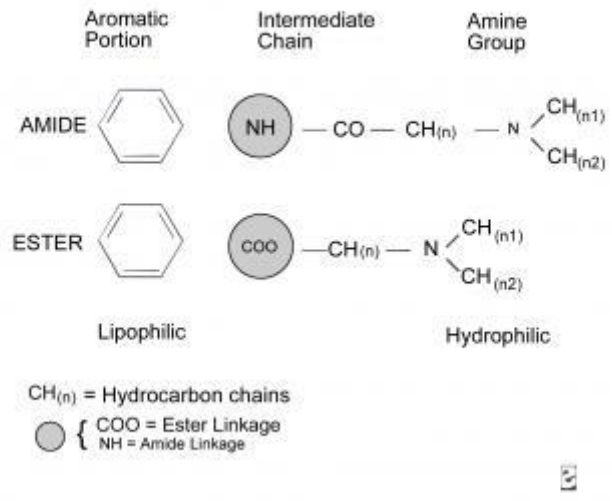

Figure 1: Molecular diagram.

The composition of local anesthetics are addition of HCl salt to the water so they are weak bases and easily injectable [81-83]. In aqueous solution between unionized and ionized form salt get equilibrates. Although the ionized form is injectable, the lipophilic properties of unionized base has responsible for its diffusion into the nerve cell membrane, so equilibration is very important process [84,85]. An anesthetic protein-binding activity determines it's duration of action and/or period during which it remains effective, because the anesthetic receptors along the nerve cell membrane are proteins [86-90].

From the figure chain that connects the amine and aromatic portions is intermediate chain and it is composed of amide/ester linkage (Figure 1). Classification of local anesthetics can be done by using this intermediate chain only [91-93].

Anesthesia providers can access all factors that influence medical condition of patient's and suitable anesthetic technique will be select accordingly [94,95].

ANESTHESIA SIDE EFFECTS

Many side effects of anesthesia were minimized because of its research development and quality practice by anesthiologists, but to reduce fewer side effects like “after subjected to anesthesia patients might feel sick, feeling like [0] vomiting, sometimes faint, sore throat which may last for few hours to few days based on the individual and anesthetics,” furthermore development in its research is also require [96-98].

Compared to other procedures like medical and surgical, to provide unconsciousness the safe procedure is anesthesia. Even though some adverse actions like mental confusions, shivering, fainting will evolve by application of anesthesia and these conditions may last for few hours to few days [99,100]. Some rare cases death also takes place including stroke, heart attack, bladder problem etc.

SUMMARY

Compared to general and systemic anesthetics, Local anesthetics are safe. So they were use whenever require. In addition, these are available easily and mode of administration is also easy. From centuries research and development of local anesthetics have been undergoing, and still research is required to provide patients with maximum safety and great efficacy anesthtics. Also development of different variety of anesthtics with different pharmacological activity is needed to provide the surgeons with advanced anesthetics and to treat patient with safer anesthetics.

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