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RESEARCH ARTICLE

Efficacy of Local Anesthetics on Alcoholics

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Abstract

Pain and fear of pain are the major cause and also the drawback for patient to seek for dental treatment. Local anesthetics are very useful in management of pain. Some patient feel that alcohol are choice of managing the pain than dental treatment, but many do not know that alcohol can affect the efficacy of local anesthesia used in dental treatment especially extraction

Introduction

Alcohol, one glass a day (male: <21 units per week, <3-4 units a day; female: <14 units/week, <2-3 units a day) helps in proper functioning of heart, but excess alcohol affects the heart and will be unable to pump required blood to the other parts of the body. Besides, it will also affect the functioning of endocrine glands which is responsible for metabolism, tissue function and secretion of growth hormone.

Local anesthetic is characterized by loss of sensation only in the area of body where the anesthetic drug is applied or injected. There are different types of local anesthetic dugs available in the dentistry field with different characteristic and their uniqueness.

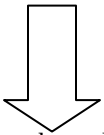
The pH of alcohol and the suitable pH for local anesthetics to be absorbed and diffused are contraindicated. Besides, the alcohol content in the body may slow down the action of local anesthesia and affects the efficacy of local anesthetics. Alcohol may also affect the quantity of local anesthetic given prior to the procedure. In some patient with organ failure, it may be life threatening to the patient.

Mechanism of Local Anesthesia

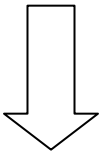
Local anesthesia blocks the conduction in the peripheral nerves that inhibited the nerve to excited and created anesthesia.

Displacement of calcium ions from the sodium channel receptor site,

which permits binding of the local anesthetic molecule to the receptor site



This produces blockade of sodium channel and decrease in sodium conductance



Leads to depression of rate of electrical depolarization and failure to achieve threshold potential level along with lack of development of propagated action potentials known as conduction blockade[1]

Pharmacokinetics of Local Anesthetic

Once the local anesthetic absorbed into the blood, it is distributed throughout the body to all tissues. Highly perfused organ (eg. Brain, head, liver, kidneys, lungs, and spleen) have higher anesthetic blood level than other organs.
Blood level of local anesthetic is influenced by few factors:

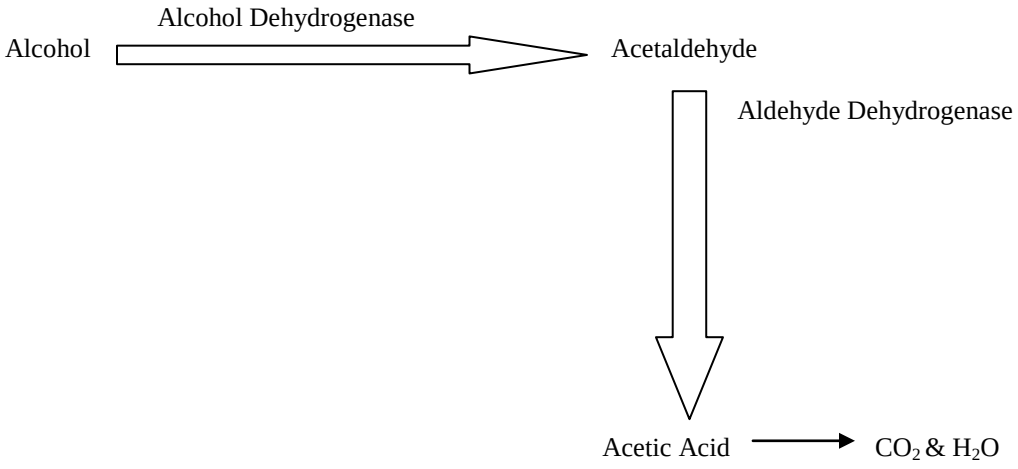
1. Rate at which drug is absorbed into cardiovascular system
2. Rate of distribution of the drug from vascular compartment to the tissue
3. Elimination of drug through metabolic or excretory pathway.

Rate at which the local anesthetic is removed from blood is described as elimination half life. Elimination of half life differs in every drug available. [2]
Local anesthetics can be separated into 2 different groups, ester and amide. Ester local anesthetics are hydrolyzed in plasma by enzyme pseudocholinesterase. Different types of amide local anesthetics are more complex as compared to ester local anesthetics. The primary site of biotransformation is the liver. Lidocaine, mepivacaine, etidocaine and bupivacaine are metabolized in the liver and have similar rate of biotransformation.[3]
Excretions of the local anesthetics are from the renal route, which makes kidney the primary excretory organ. Esters appear only in small concentration as parent compound in the urine because they are hydrolyzed almost completely in plasma. Amides usually are present in the urine as the parent compound in a greater percentage than the esters because of their more complex biotransformation. [4]

Pharmacokinetics of Alcohol

When alcohol is ingested, a small amount (about 20%) is quickly metabolized in the stomach. The remaining alcohol, most of it, is then absorbed into the bloodstream from gastrointestinal tract and upper small intestine. Absorption of alcohol occurs slowly in the stomach and rapidly as it reaches the upper small intestine. Once absorption is done, it is then transported to the liver through portal vein.[5] A small portion will get metabolized during the passage to the liver while others will be distributed throughout the body. Alcohol travels through blood and comes in contact with cells of all organs. Since alcohol is a highly volatile with high affinity towards water, it can penetrate almost all cellular membranes resulting in absorption.
Ethanol has the ability to damage or destroy every cell in the body. Reasons are:

1. It is found in all body fluids surrounding the cell, including blood, urine, saliva, spinal fluid and tears.
2. Repeated use of alcohol in certain concentrations is toxic to body tissue.
3. Alcohol gets converted to acetaldehyde which is a metabolite more toxic than parent compound.



Effects of Local Anesthetics

Local anesthetics readily cross the blood brain barrier and causes depression in the central nervous system. They have anticonvulsant properties, which can be used to terminate and/or decrease the duration of seizures. This feature is very useful for epileptic patients. Whereas in cardiovascular system, local anesthetic has direct action on myocardium and peripheral vasculature. On myocardium, there's depression which causes decrease in electrical excitability, decreases conduction rate and decreases the force of contraction. On the peripheral vasculature, there is relaxation of smooth muscle in the walls of blood vessels. This leads to increase blood flow to and from the site of deposition of local anesthetics. [6-7]

Effects of Alcohol

How does alcohol affect the body? The nerve cells in the brain communicate through chemical messengers called neurotransmitters. There are two main types of neurotransmitters and neurotransmitter receptors, excitatory and inhibitory which determine the response of the signal receiving neuron. Excitatory neurotransmitters and the receptors increase the neuron's intrinsic electrical activity and excitability, whereas inhibitory neurotransmitters and their receptors reduce neuronal excitability. The brain must balance the excitatory and inhibitory influences in order to achieve proper functioning. Excessive excitation can lead to seizures, whereas excessive neuronal inhibition can result in incoordination, sedation and anesthesia. [8]

Gamma Aminobutyric Acid(GABA) is the primary inhibitory neurotransmitter in the central nervous system. Alcohol intoxication is accompanied by the incoordination and sedation indicative of neuronal inhibition. $GABA_A$ receptors are large protein encapsulated in cell membranes of neurons. Each receptor consists of five protein molecules that assemble so that a channel formed at center of the complex. When GABA molecules bind to the receptor and activate it, the channel temporarily opens and allows the passage of negatively charged molecules (eg Cl^-) to pass from the cell's exterior to interior. The ion flow decreases the cell's excitability. The cumulative neuronal inhibition caused by GABA's binding to many neurons results in sedation and intoxication.[9]

Discussion

Alcohol affecting the efficacy of local anesthetic depends of the dosage and quantity. Alcohol ingestion use to relieve pain has proven to be relevant but as the body develop tolerance and addiction towards the alcohol, patient have to increase the dosage and quantity to achieve analgesic property. To achieve analgesic property, orally administered ethyl alcohol (1ml/kg of 100% ethyl alcohol + 1ml/kg tonic water) produced tolerance to pain comparable to 0.17mg/kg s.q. morphine. [10]

pH of alcohol and local anesthetic plays a role in the efficacy of local anesthetic induced. pH of alcohol is of acidic in nature which alters the blood pH by altering the kidneys' ability to maintain blood levels of phosphate. Alcohol decreases blood pH level which leads to acidic blood. When blood is acidic, it decreases the cell function and creates environment preventing the dissociation of the local anesthetic molecules. A suitable pH for local anesthetics to act is around 7.3-7.4 which is the normal pH of the blood in human body.

The toxins in alcohol can erode liver cells which in turn makes process of metabolism of alcohol difficult. In patient suffering of liver failure or liver disease, metabolism of alcohol becomes impossible. If local anesthetic given to the alcoholic patient, it may cause liver dysfunction and causes abnormal coagulation of blood which will then causes uncontrollable loss of blood.

In patients with heart disease, they are more sensitive to the local anesthetics and patient may go into cardiogenic shock. For long term alcoholic patient with cardiac problem, the dosage of local anesthetic needed is more compared to the normal quantity. Heart rate, blood pressure and respiratory rate will be elevated in alcoholic patient. In high dose of local anesthetics, respiratory arrest and cardiac arrest has high possibility of occurring in alcoholic patient.

Conclusion

Alcohol and local anesthetic are never a good combination in any treatment modality be it dentistry or medicine. Transient relief of pain brought about by consumption of alcohol is not desirable, rather it produces variety of deleterious effects to the body. Alcohol does not cure but rather affects the cardiovascular, respiratory and metabolism system to fail which leads to multiple organ failure.

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