



LONG ACTING LOCAL ANESTHETICS IN DENTISTRY- A review

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ABSTRACT

The aim of this review is to provide an adequate knowledge on long acting anaesthetics like Bupivacaine, tetracaine, etidocaine, ropivacaine and merivacaine in oral cavity along with its complications which include both local and systemic complications. Local anesthesia is defined as a loss of sensation in a circumscribed area of the body by a depression of excitation in nerve endings or an inhibition of the conduction process in the peripheral nerves. The reason for this review is to provide sufficient knowledge on long acting anaesthetics along with its complications.

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INTRODUCTION

For more than 100 years, local anesthetics has been in use in dental practice. The advent of local anaesthetics with the development of nerve blockade injection techniques heralded a new era of patient comfort while permitting more extensive and invasive dental procedures. Dentists are able to select an anaesthetic that acquires certain definite properties such as time of onset and duration, hemostatic control, and degree of cardiac side effects that are appropriate for each individual patient and for each specific dental procedure due to advance and availability of variety of local anesthetic agents.[1]

Both intra-operative and postoperative pain has been proved to be effectively suppressed by the use of long-acting local anesthetics [2]. There are several factors that influence the choice of local anesthetics; they should meet the expectations for post-operative pain management by providing effective anesthesia and analgesia for the duration of the procedure. The local anesthetic drugs that are currently available for use in dentistry are divided into three categories. Short-acting drugs, such as 4% prilocaine, 3% mepivacaine, and 2% lidocaine, provide 30 min or less of pulpal anesthesia. Few examples of intermediate duration agents (approximately 60 min of pulpal anesthesia) are two percent lidocaine with 1:100,000 epinephrine, 2% mepivacaine with 1:20,000 levonordefrin, 4% prilocaine with 1:200,000 epinephrine, and 2%

procaine plus 0.4% propoxycaine with either 1:20,000 levonordefrin or 1:30,000 norepinephrine. Long-duration agents (up to 90 min or more of pulpal anesthesia) include 0.5% bupivacaine with 1:200,000 epinephrine, and 1.5% etidocaine with 1:200,000 epinephrine. Ropivacaine is ultimately proved to be useful in the practice of dentistry as a third long-duration local anesthetic agent.[2]

Lidocaine

It is also known as xylocaine and lignocaine. It is the most widely used local anesthetic agent in dentistry is 2% lidocaine with 1:100,000 epinephrine. It is routinely used for all types of dental procedures ranging from simple amalgam restoration to complex surgical procedures due to its explicit properties such as rapid onset, low toxicity, low incidence of allergy, and its relatively low cost when compared to other anesthetic agents. Sleepiness, muscle twitching, confusion, changes in vision, numbness, tingling, and vomiting are some of its common side effects with intravenous usage. It can also cause low blood pressure and an irregular heart rate.[3] Its use in pregnancy is generally considered to be safe. Patients involved with liver problems have to be provided with lower dose of the agent.[3] It is generally safe to use in those allergic to tetracaine or benzocaine.[4]

Bupivacaine

It is a local anaesthetic of the amide group.[1] It is indicated for local infiltration, peripheral nerve block, sympathetic nerve block, and epidural and caudal blocks. At times it is used in combination with epinephrine to prevent systemic absorption and extend the duration of action.

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Sleepiness, muscle twitching, ringing in the ears, changes in vision, low blood pressure, and an irregular heart rate are a few possible side effects of bupivacaine. It is contraindicated in patients with hypersensitive reactions to bupivacaine or amino-amide anesthetics. It differs from mepivacaine only in the substitution of a butyl group for the methyl group at the amine end of the molecule. Although the structural formula differs only slightly but chemically it differs significantly. Bupivacaine and etidocaine have structural formulae which differ only slightly from those of mepivacaine and lidocaine, respectively, they differ by some physicochemical properties. Bupivacaine and etidocaine have, for example, a much higher degree of lipid solubility and protein-binding capacity.[5]

Etidocaine

Duranest is the trade name under which etidocaine is marketed., it is an amine type local anesthetic given by injection during surgical procedures. It is similar in structure to lidocaine but differs by an addition of a propyl group for an ethyl group at the amine end and an addition of an ethyl group on an alpha carbon on an intermediate chain. It is 50 times more lipid soluble than lidocaine. Its plasma protein binding is similar to that of bupivacaine (95%) and greater than that of lidocaine (65%) or mepivacaine (75%). It has also been reported to produce a lower blood concentration.[2] Etidocaine has a long duration of activity, but the main disadvantage of using it during dentistry is that it increases bleeding during surgery.[6]

Tetracaine

Tetracaine is an ester-type long-acting local anesthetic. It has delayed onset and significant toxicity; it is not used by injection for dental local anesthesia. In biomedical research, tetracaine is used to alter the function of calcium release channels that control the release of calcium from intracellular stores. It is an allosteric blocker of channel function. At low concentrations, tetracaine causes an initial inhibition of spontaneous calcium release events, while at high concentrations, it blocks release completely.[7] It is mainly used topically in ophthalmology and as an antipruritic, and it has been used in spinal anesthesia.

Ropivacaine

It is also a local anaesthetic drug which belongs to the aminoamide group. [2] Its name refers to both the racemate and the marketed S-enantiomer. Ropivacaine is indicated for local anaesthesia including infiltration, nerve block, epidural and intrathecal anaesthesia in adults and children over 12 years. It is also indicated for peripheral nerve block and caudal epidural in children 1-12 years for surgical pain. It is also sometimes used for infiltration anaesthesia for surgical pain in children.

Mepivacaine

It is supplied as the hydrochloride salt of the racemate, [8] which consists of R (-)-mepivacaine and S (+)-mepivacaine in equal proportions. These two enantiomers have markedly different pharmacokinetic properties. [9] It is a local anesthetic [10] of the amide type. Mepivacaine has a reasonably rapid onset and medium duration of action and is marketed under various trade names including Carbocaine and Polocaine.

The onset time, duration of anesthetics and analgesia of certain local anesthetics have been tabulated in table 1.1.

Table 1.1 Anaesthetics and its duration of onset, analgesia and anaesthetics

Anaesthetics	Onset (min)	Duration of anaesthetic (hr)	Duration of analgesia (hr)
3% 2-Chloroprocaine + epinephrine	10-15	1.5-2	2-3
1.5% Mepivacaine	10-20	2-3	3-5
1.5% Mepivacaine + epinephrine	10-20	2-5	3-8
2% Lidocaine + epinephrine	10-20	2-5	3-8
0.5% Ropivacaine	15-30	4-8	5-12
0.75% Ropivacaine	10-15	5-10	6-24
0.5% Bupivacaine + epinephrine	15-30	5-15	6-30

Complications

Complications include both local and systemic complications.[11] Local complications include spread of infection, hematoma, nerve damage and blockade of the facial nerve. Where as systemic complications include regional or systemic infection, endocarditis risk, Pseudocholinesterase deficiency, cardiovascular disease, liver disease and Methemoglobinemia.

Local Complications

Spread of infection: seldom infections spread into these issues by the needle as it passes through a contaminated tissue or by contamination of the needle itself before its use. Hematoma: Hematoma is formed as a result of damage of a blood vessel caused by the tip of a needle which may lead to bleeding within these tissues. Significant bleeding may cause pain, swelling and trismus. Nerve damage: at times, the needle may pierce a nerve bundle during its placement, producing an immediate electric shock sensation to the patient. It is usually followed by a partial sensory deficit, but subsequently a complete return to normal sensation usually follows. Blockade of the facial nerve: a motor blockade causing temporary paralysis of the muscles of facial expression may occur if the injection is provided in close proximity to the facial nerve. The effect may last for an hour or two.

Systemic complications

Regional or systemic infection: passage of a needle through an infected area within the perioral tissues can be potentially spread through planes of the head and neck. Endocarditis is a risk: certain injections like the intraligamentary injection can force bacteria into the systemic circulation and cause bacterial endocarditis. Cardiovascular disease: patients with cardiac related problems show higher plasma levels of lidocaine when compared with that of healthy subjects given the same dose. Therefore it is recommended that the maximum safe dose be halved in such patients. [12] Liver disease: an abnormally decreased rate of metabolism of amide local anaesthetics, resulting in potentially toxic blood levels is exhibited in patients with reduced hepatic functions. Dosage levels must therefore be reduced for these patients. Methemoglobinemia: this is a rare complication caused by a metabolite of prilocaine that oxidizes the ferrous component of heme in red blood cells to the ferric state. This reduces their oxygen delivering capacity and results in tissue hypoxia.

CONCLUSION

Longactinglocalanestheticshave a rapid onset of action, a minimal incidence of associated side effects, they delay the onset of post operative pain and also reduces the intensity of post operative pain. Hence it is effective for suppression of intra operative pain. The most signify cant depressant and dysrhythmogenic effects on the cardiovascular systemic of bupivacaine. Etidocaine may have a slightly more rapid onset of action, but its use may be associated with increased intraoperative bleeding. A new long-acting local anesthetic, ropivacaine, may be effective for prolonged anesthesia and post operative analgesia without the need for added vasoconstrictor.

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