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Local Anaesthesia in Dentistry- Lignocaine too Good or Articaine the Best?

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Abstract

Local anaesthesia is key to painless dental surgical, endodontic and operative procedures. Lignocaine is the gold standard for pain management in dentistry since ages. But, articaine is more potent than lignocaine in attaining infiltration local anaesthesia with low toxicity. Currently, articaine is extensively utilized in dentistry however infrequently used in children. Nevertheless, for selection of local anaesthetic; potency, latency, and duration of anaesthetic effect, pharmacokinetics and toxicity of anaesthetics should be evaluated. Therefore, we will discuss whether "lignocaine is too good or articaine is the best" to accomplish complete pain control with safety and efficacy.

Keywords: Articaine; Dental care; Lidocaine; Lignocaine; Local anaesthetics; Oral health

Introduction

Anxiety is the most frequent basis of dental fear. Local anaesthesia is key to painless dental surgical, endodontic and operative procedures. Local anaesthetics for dentistry are categorized as amides (lignocaine, mepivacaine, prilocaine) and esters (cocaine, benzocaine, procaine, tetracaine, butacaine).

Lignocaine was launched for dental use in 1948; thereafter it is the gold standard for pain management in dentistry. Lignocaine belongs to amide having intermediate duration of action [1]. Furthermore, articaine has got approval in United States in 2000 which is amide anaesthetic having intermediate duration of action however it has a thiophene ring rather than benzene ring of amide group [2,3]. Another molecular disparity is the additional ester linkage integrated with articaine molecule causes hydrolysis of articaine by plasma esterases [4]. It is offered as a 4% solution with 1:100,000 epinephrine.

For selection of anaesthetic; potency, latency, and duration of anaesthetic effect, pharmacokinetics (absorption, distribution, metabolization, and excretion) and toxicity of anaesthetics should be evaluated. Hence, we will discuss the comparison of two giants of local anaesthesia in dentistry.

Anaesthetic efficacy and metabolism

Articaine is the core of intense debate in dentistry because of quick onset and higher success rates than lignocaine. Few of advantages of articaine can be described as: articaine does a transient but completely reversible state of anaesthesia during; also, it is used for infiltration as well as block technique in dentistry, and when employed by block technique causes longstanding anaesthesia; moreover, in patients having hypokalemic sensory overstimulation, lignocaine is not that useful, however articaine do well [2,5]. Studies concluded that patients treated with articaine become "drug free" more rapidly compared with other local anaesthetics [6].

Articaine is marketed as Septocaine as a 4% solution with 1:100,000 epinephrine but lidocaine is a 2% solution. Equal analgesic efficacy and low systemic toxicity helps articaine use in higher concentrations compared with other amide local anaesthetics [7]. Literature reveals that 90-95% of articaine is metabolized in the blood and only 5-10% is broken down in the liver [7]. The plasma half-life of articaine is 20 minute [8]. Lignocaine and articaine both has similar recommended dose of 6.6-7 mg/kg of patient [2]. The onset time of anaesthesia is directly proportionate to rate of epineural diffusion, dependent on percentage of drug in the base form, which is proportional to the pKa of drug. pKa was 7.8 for articaine and 7.9 for lidocaine [9].

It shows that articaine and lignocaine are equally effective to offer inferior alveolar nerve block, intraligamentary or infiltration techniques in irreversible pulpitis and compared articaine and lidocaine for inferior alveolar nerve blocks [10,11] checked articaine and lignocaine efficiency in infiltration anaesthesia [8]. Studied effectiveness of articaine and lidocaine for intraligamentary injected by computer-controlled local anaesthetic delivery system [12]. However, these researches have reported no significant differences among articaine and lidocaine for different intraoral local anaesthetic techniques.

It is further assessed in 20 patients by way of maxillary molars infiltration, confirmed that articaine created quick onset plus extended duration of action when compared to lignocaine [13].

But, research evaluated articaine and lignocaine with buccal infiltration which had a success rate of 45-57% with lignocaine and 75-92% with articaine [3,14]. and anaesthetic efficacy of 4% articaine against 2% lidocaine, both having epinephrine 1:100,000, using inferior alveolar nerve block for surgical extraction of impacted mandibular third molars. They observed articaine had superior clinical results than lidocaine, especially for latency and duration of anaesthesia [15]. and assessed articaine and lidocaine for maxillary infiltrations [16] assessed a supplemental buccal infiltration using articaine or lidocaine for mandibular first molar after an inferior alveolar nerve block [17]. Both reported articaine as appreciably superior anaesthetic as compared to lidocaine for infiltrations. This

effectiveness may be because of increased diffusion of the articaine solution which is due to thiophene ring in molecule, that boost lipid solubility thus permitting solution to cross the lipid membrane [18]. Because of the increased diffusion articaine produces complete pulpal plus palatal anaesthesia following maxillary buccal infiltration; hence painful nerve block can be avoided particularly for children.

In 2009 it is evaluated tha the efficacy of inferior alveolar nerve blocks using 4% articaine with 1:100,000 epinephrine versus 2% lidocaine with 1:100,000 epinephrine in patients having irreversible pulpitis [19]. The success rates were 65% with articaine moreover 45% with lidocaine. But, sample size was small which may have caused statistically insignificant difference with articaine somewhat effective compared to lidocaine and compared them for infiltration to maxillary first molars having irreversible pulpitis; reported no significance different between lidocaine and articaine [20,21]. The meta-analyses concluded effectiveness of articaine over lidocaine for infiltration injection [22,23] and compared the pulpal anaesthesia of 2% lidocaine and 4% articaine in 32 patients having incipient caries in mandibular first molar using buccal infiltration. The mean time of onset of pulpal anaesthesia was 6.92 min for 4% articaine and 10.35 min for 2% lidocaine and the difference was highly significant. They observed 4% articaine had superior changes from baseline pulp tester readings than 2% lidocaine [24].

Thus, articaine should be first choice of anaesthetic in children in children above 4 years of age [25]. Existing meta-analysis could not confirm recommendations for its use in children below 4 years of age, since no supporting data were found [22]. While treating younger children, a body weight-based dosage should be calculated to prevent toxicity [26]. Because of high efficacy, tolerance and safety, articaine 4 % solution with reduced epinephrine concentration (1:400,000) is a safe and appropriate anaesthetic for pediatric dental treatments. For longer and extremely painful procedures and treatments which needs ischaemia, solutions with higher concentrations of epinephrine should be favoured [27].

Safety

The allergic reactions to lignocaine are very exceptional, and true allergic reactions to local anaesthetics are less than 1% of the entire adverse reactions [28,29] and reported generalized urticaria and erythmatous pruritic rash after 10 minutes of a skin prick test using 2% lignocaine [30]. Similarly it is observed that a 50-year-old male patient with itching and generalized skin reaction in 5 minutes following intradermal test dose of lignocaine [31]. and documented delayed hypersensitivity with lignocaine [32,33] and reported a severe classical type I hypersensitivity reaction i.e. anaphylaxis after utilizing lignocaine for dental procedure; however history of positive skin prick test with preservative free plain 2% lignocaine was present [34]. Therefore, the immediate reactions, mainly Type I may cause lethal consequences when left untreated. In contrast of ester type, allergy to an amide local anaesthetic does not prohibit utilization of another amide local anaesthetic [29]. However in few cases lignocaine have shown cross sensitivity with mepivacaine [35].

For, Most of the adverse reactions of articaine happen because of amount of epinephrine with the analgesic [36]. Vasoconstrictor must be avoided when history of allergy to sulphites seen, since metabisulfite is present as an antioxidant for vasoconstrictor [9]. Articaine is not recommended for patients allergic to amide anaesthetics and metabisulfites (preservative of epinephrine). It must not be used for patients having hemoglobinopathies (sickle cell disease) and idiopathic or congenital methemoglobinemia. But, articaine can be used for patients with sulfa allergies; since no cross-allergenicity seen with sulfonamides.

They evaluated safety of 4 % articaine with 1:400,000 epinephrine and 1:100000 epinephrine in 999 children with a minimal insignificant side-effect [37,38]. Furthermore, time of onset of anaesthesia was observed as less in children than adults which may be related to cancellous nature of maxilla and mandible in children [38]. Toxicity of 4% articaine as compared to lowered concentrations was observed as non-significant [39]. Speedy inactivation of articaine by plasma esterases explains the absence of overdose reactions reported, because articaine has the shortest metabolic half-life of anaesthetics used in dentistry [40]. Comparative central nervous system toxicities of articaine and lidocaine are about 1.5 and 2 correspondingly in animal studies. Central nervous system toxicity of articaine was confirmed to be less than lignocaine in humans; an unintentional intravascular injection of about 80 mg of 4% articaine not caused toxicity to healthy patients [41]. Neurological adverse effect happen subsequent to a toxic level of local anaesthetic crosses the blood brain barrier. Early signs comprise slurred speech, muscle twitching, visual disturbances and disorientation, but increased dose lead to convulsions and seizures [42].

For allergy testing; local anaesthetic drug along with bisulfite sensitivity must be considered, because local anaesthetic with vasoconstrictors can be used for treatment when both tests negative. If an allergist is not able to recognize suitable local anaesthetic, at the same time a general anaesthetic has not recommended than diphenhydramine (benadryl) infiltration can be utilized. It is an antihistamine with efficacy to block sodium channels in peripheral nerves. It is not as efficient as local anaesthetics also irritating to tissues and should be used as a 1% (10 mg/ ml) concentration. It should be used for single-tooth or localized soft-tissue procedures of 15-20 minutes by injecting less than 2 ml (20 mg) total because higher dose may cause sedative effects [43].

Conclusion

The diversity of anaesthetics currently available which requires dental professionals to assess the drug both by its pharmacokinetic and clinical characteristics for better patient compliance and complete pain control. Since local anaesthetics are frequently used drug in dentistry, dentists must know symptoms of various allergic reactions and its management.

Recommendations

The veterinary personnel in Kajiado County should make an effort to investigate all cases of abortions and retained placentas that are included in their disease surveillance reports. This calls for strengthening laboratory diagnostic capacity in the county by training more veterinary and health staff and providing diagnostic equipment and reagents. Creating awareness among the people on the seriousness of the causes, modes of transmission, risk factors and methods of prevention of the two diseases should be undertaken as soon as possible.

Slaughter house workers and other veterinary personnel should wear protective gear when in contact with fresh animal tissues.

Effort should be made by health personnel to do a confirmatory diagnosis of all diseases presenting flu-like symptoms before treatment to avoid misdiagnosis, drug misuse and long suffering of patients.

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