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Neutral Anesthetic Solution for Facial Aesthetic Procedures

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Abstract

Local anesthetics act selectively, paralyzing the ends and fibers of sensory nerves, thereby blocking the reception and transmission of painful stimuli. Cosmetic patients expect minimally invasive, painless, and effective procedures to enhance their appearance and boost self-confidence. Providing treatments with minimal pain and maximum patient comfort should be every professional's goal. We present the preparation of the Pithon's Neutral Anesthetic Solution (SANEP), composed of 1.2 mL lidocaine with epinephrine (2% and 1:200,000), 0.2 mL sodium bicarbonate (8.4%), and 8.6 mL sodium chloride (0.9%), for use in daily facial aesthetic procedures. We observed rapid absorption and action, resulting in less burning and pain. We also emphasize the importance of this composition because it offers excellent durability without toxic effects for patients undergoing facial aesthetic procedures. SANEP features an effective and satisfactory formulation for the clinical practice of minimally invasive procedures in the facial region.

Keywords: anesthesia, nerve block, lidocaine, sodium bicarbonate, aesthetics

Introduction

Patients undergoing cosmetic procedures expect minimally invasive, painless, and effective procedures that improve their appearance and boost their self-confidence. Providing treatments with minimal pain and maximum comfort for the patient should be the goal of every professional, as should ensuring painless recovery times (1).

Different types of anesthesia - topical, local, regional and general - are used depending on the complexity of the procedure, the patient's health and the desired results (2). While local anesthesia is the most common in dermatology due to its effectiveness and low risk, more complex cases may require regional blocks or general anesthesia (3). Each technique has its own set of benefits and limitations, and the type of anesthesia chosen for the procedure, can significantly alter postoperative healing, affecting scar formation and cosmetic results (2, 4).

Local anesthetics act selectively, paralyzing the ends and fibers of sensory nerves, thus blocking the reception and transmission of painful stimuli. They work at the injection site to regionally restrict the conduction of centripetal impulses. Their action is reversible, and the duration of anesthesia is variable and depends on the properties of the compound and its pharmacokinetic parameters (rates of absorption, metabolism, and elimination) (1).

It is clear that dermatological anesthesia has advanced significantly since its inception, enabling the achievement of necessary analgesia and patient comfort. With further research, pain control in dermatological procedures will undoubtedly continue to advance, refining established methods or developing entirely new, more effective medications. In this article, we present the composition of the neutral anesthetic solution (Pithon's Neutral Anesthetic Solution - SANEP)) used in our daily clinical practice in facial aesthetics.

Body Text

The proposed local anesthetic solution contains the classic components used by other facial surgery and/or facial aesthetic procedure professionals. We recommend preparing it minutes before application and storing it at 8°C for a few hours. Pithon's neutral anesthetic solution (SANEP) is prepared in the following proportions: 1.2 mL of 2% lidocaine hydrochloride (1:200,000 in epinephrine); 0.2 mL of 8.4% sodium bicarbonate; and 8.6 mL of 0.9%

sodium chloride (Figure 1). We recommend using a 30G disposable needle for application and keeping the solution at room temperature for optimal patient comfort during application.

In facial aesthetic clinical practice, we have observed that reducing the sodium bicarbonate dosage prevents crystallization of the solution and, consequently, needle clogging during application. This solution produces immediate local anesthetic results, lasting approximately 40–80 minutes. Ensuring comfort and safety, reducing the lidocaine dosage prevents toxic effects on the patient.

Figure 1. Products used in the composition of the SANEP solution.

Results and Discussion

The selection of a local anesthetic that doesn't cause sleepiness is largely based on the clinician's experience and comfort level, but it's also impacted by patient factors and concerns. It's crucial that injectors are aware that pain is a common barrier to aesthetic procedures, and alleviating fears of painful interventions is essential for patient satisfaction. Prior medical history, including clinical history, allergy data, and possible contraindications to the use of any component of the formula, is also crucial.

Clinical observations and experimental reports agree that the presence of inflammation can impair the effectiveness of local anesthetics. A low pH in the extracellular space impairs the ability of local anesthetics to cross the nerve sheath and membrane by reducing the proportion of anesthetic in its free lipophilic base (5). Adding vasoconstrictor drugs to the anesthetic base prolongs the duration of the effect and reduces systemic toxicity. The drug absorption rate is reduced, and the anesthetics pass less quickly into the circulation, remaining at the injection site longer. Consequently, the use of vasoconstrictors allows for a smaller amount of local anesthetic to be required for effective nerve blockade. The use of vasoconstrictors, the most common being adrenaline, epinephrine, norepinephrine, and felypressin, reduces the required systemic dose of a given anesthetic by 50% (6). Overdosage of vasoconstrictors, which are generally incorporated into local anesthetic solutions, has also been associated with fatal cases, caused by a sudden increase in blood pressure followed by intracranial hemorrhage in susceptible patients (7).

When choosing an anesthetic agent, it is important to consider the type of procedure, the time required for anesthesia, and the pharmacodynamics of each drug.

Lidocaine binds reversibly to voltage-gated sodium channels and prevents the flow of sodium ions through the channel pore. This prevents both the depolarization of nerve cell membranes and the propagation of action potentials, which are necessary for sensory signal transduction. This prevents both the depolarization of nerve cell membranes and the propagation of action potentials, which are necessary for sensory signal transduction (8). Lidocaine exhibits state-dependent blockade; it binds and deactivates sodium channels in the active state with greater affinity than those in the resting state. This property is believed to play a crucial role in its therapeutic effects. Impulse blockade requires concentrations high enough to block channels in the resting state (9). Its use as a classic local anesthetic demonstrates that intravenous lidocaine infusions have many potential effects, such as anti-inflammatory, organ-protective, and anticancer effects (10-12). Its anti-inflammatory properties in the perioperative period have attracted much attention, and the analgesic effect of its anti-inflammatory properties has been demonstrated (13).

Lidocaine is a systemic antiarrhythmic; it is currently the most widely used injectable anesthetic in dermatology. Its onset of action is rapid (<1 min) and its duration is intermediate (30–120 min) (3). Lidocaine is an aminoamide-based local anesthetic. Due to its superior safety profile compared to other local anesthetic agents, it was rapidly adopted. It is used to treat acute to chronic pain (14, 15). Lidocaine must be used with caution, as high doses can lead to systemic toxicity, and in some patients, allergic hypersensitivity may occur, causing allergic contact dermatitis (16). Lidocaine is the most widely used anesthetic, either alone or in combination with other components. It can be used by pregnant and breastfeeding women with caution due to its excretion in breast milk (17). Lidocaine is unstable at a pH of 7.9. Therefore, it is formulated at an acidic pH to increase its stability and shelf life. The resulting pH is 4.7. This is well below the physiological pH and can lead to tissue irritation, which may be perceived by the patient as a stinging or burning sensation (18, 19).

Sodium bicarbonate can be added to lidocaine to increase the pH of the anesthetic solution and reduce the burning or stinging sensation. Sodium bicarbonate ($NaHCO_3$) increases the pH of the local anesthetic solution, thereby increasing the fraction of non-ionized drug able to cross the neuronal membrane (20). It reduces the pain of the injection (21). Furthermore, by alkalizing the solution, it accelerates the onset of anesthesia.

Alkalization can have benefits. First, the patient may experience less discomfort due to the higher pH of the solution. Second, the pH of the injected solution may more quickly approach the pH of typical tissue after injection. The faster a mixture of charged and uncharged forms is formed, the faster drug diffusion and nerve blockade will begin. This can be especially useful in body sites where there may be a delay in pH rise after injection due to inadequate tissue buffering capacity (22). In the medical world, the idea of local anesthetic tamponade is widely accepted. In a systematic review by Davies (2003) on local anesthetic tamponade, it was found that using sodium bicarbonate as a tamponade significantly decreased injection discomfort without compromising efficacy (23). In a recent study where bilateral maxillary orthodontic extractions were performed on 102 patients, it was also found that local anesthetic buffered with sodium bicarbonate was considered more efficient than conventional local anesthetic in terms of reducing pain on injection, as well as faster onset and longer duration of action (22).

The literature presents different concentrations and proportions with or without the use of bicarbonate, which reduces the discomfort caused by subcutaneous infiltration. Jeffrey Klein's solution (1988) (24) contains: 1 L of saline solution (0.9%) + 50 to 100 mL of 1% lidocaine with epinephrine 1:100.00 (contains 500 mg to 1 g of lidocaine and 0.5 mg to 1 mg of epinephrine) + 10 mL of 8.4% sodium bicarbonate (10 milliequivalents = 10 mEq). Klein (2016) (25) presents the following formulation: maximum of 1 g of lidocaine and 1 mg of epinephrine in 100 mL plus 10 mEq of sodium bicarbonate in 10 mL added to 1000 mL of 0.9% physiological saline solution for a final lidocaine concentration of 1 g per bag containing 1110 mL or 0.9 g/L (0.09%). In an editorial by the British Association of Oral and Maxillofacial Surgeons, a tumescent solution composed of 500 mL of saline solution, 50 mL of lidocaine, 1 mL of adrenaline (1:1000) and 6 mL of 10% sodium bicarbonate is presented (26).

Decades have passed without changes since the first anesthetic formulation consisting of lidocaine + epinephrine, sodium bicarbonate, and sodium chloride. Compared to Klein's first formulation (83.3% saline solution, 8.3% lidocaine + epinephrine, and 8.3% sodium bicarbonate), our SANEP anesthetic solution (86%, 12%, and 2%, respectively) (Table 1) is consistent with what has been proposed for decades, with the necessary adjustments to provide a more comfortable experience for our patients. Professionals have gained the freedom to adjust doses to achieve maximum patient comfort through nerve blockade.

Table 1. Comparison of the composition of Klein and SANEP solutions.

Klein, 1988		SANEP	
0.9% Sodium chloride Or Ringer's with lactate = 1000mL	83,3%	0.9% Sodium chloride = 1.200mL	86%
2% lidocaine hydrochloride (1:200,000 in epinephrine) = 50 – 100mL	8,3%	2% lidocaine hydrochloride (1:200,000 in epinephrine) = 0.200mL	12%
8.4% sodium bicarbonate = 10mL	8,3%	8.4% sodium bicarbonate = 8.600mL	2%

Some studies compare the use of lidocaine with or without sodium bicarbonate. Valiulla et al. (2023) (22), studied pain and duration of anesthesia action in dental patients, where the control group received 2% lidocaine with 1:80,000 epinephrine, and the other group received 2% lidocaine with 1:80,000 epinephrine buffered with 8.9% sodium bicarbonate in a 10:1 ratio. The local anesthetic buffered with 8.4% sodium bicarbonate was more effective than the conventional local anesthetic in terms of reducing injection pain, as well as faster onset and longer duration of action (22). In a clinical trial comparing the onset of pulpal anesthesia after inferior alveolar nerve block with unbuffered lidocaine 2% with epinephrine 1:100,000 (pH ~3.5) to that obtained with buffered lidocaine 2% with epinephrine 1:100,000 (pH 7.4), 71% of patients achieved pulpal anesthesia (as determined by electrical pulp testing) in less than 2 minutes, compared with 12% with the unbuffered solution (27). Kashyap and collaborators (2011) (28), evaluated the administration of anesthesia with or without bicarbonate in three nerve blocks (inferior alveolar, lingual, and long buccal) and assessed pain and anesthetic action time. There were no complaints of pain, and the solution's action time was faster in the group that received lidocaine with sodium bicarbonate (28). The use of sodium bicarbonate not only relieves pain and causes less needle clogging (e.g., 30G), but also accelerates the action of the anesthetic block.

Adverse reactions. Local anesthetics are safe when used correctly. However, although rare, they can cause some adverse reactions, including some with systemic repercussions (3). Events considered allergic may occur due to toxic reactions to local anesthetics directly in the central nervous and cardiovascular systems, often caused by excessive doses, rapid systemic absorption, or when a blood vessel is accidentally reached (29). The success of painless procedures under local anesthesia is achieved with the administration of the nerve block and slow and controlled infiltration of the tumescent solution, the basic composition of the tumescent solution being: saline solution, lidocaine, adrenaline, and sodium bicarbonate (26).

Limitations include an increased risk of toxicity when large amounts of anesthetic are required and a lack of efficacy in areas with complex innervation, such as the nose (30). Symptoms of lidocaine toxicity include: vomiting, tremors, tinnitus, blurred vision, psychosis, and muscle twitching (31).

The combination of lidocaine, sodium bicarbonate, and a smaller-gauge 27-30G needle reduces pain. Despite remarkable progress in dermatologic anesthesia, challenges remain in dosing (safe doses for each facial region of the procedure) and the precise administration of anesthetics. Efforts are underway to increase the effectiveness and duration of anesthesia while minimizing potential side effects, adverse reactions, and complications. The careful application of local anesthesia not only alleviates pain during procedures but also improves patient confidence, resulting in a positive and comfortable experience. Continuous research and advances in science will enable the development of more effective anesthetic formulas for aesthetic procedures in the future.

Conclusion

Pithon's neutral anesthetic solution (SANEP) is rapidly absorbed, resulting in less pain and burning, thereby ensuring patient comfort. Clinical experience has shown that its duration of action is effective for minimally invasive facial procedures, without causing toxicity in the proportions described.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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Authors' contributions

GDM: methodology, execution, writing, review & editing. JVMPN: conceptualization, methodology, execution, writing, review. All authors approved the final version of the article.

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