Guide to Local Anesthetic Medications

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Topical Ocular Anesthetics

Proparacaine or tetracaine drops can be applied to the ocular surface to help minimize the discomfort of subconjunctival injections. Facial prep solutions, bright lights, and repeated opening of eyes intraoperatively to adjust lid height may cause drying and ocular irritation. Treating both eyes helps increase patient comfort and cooperation. Tetracaine is the most potent topical agent (Benz 1992) and can be used directly on the tarsal plate during procedures such as ptosis repair in which anesthetic use is minimized to avoid levator muscle paralysis. Use of topical anesthetic drops should be limited in all patients to prevent iatrogenic corneal epitheliopathy. The postoperative analgesic regimen should never include topical ocular anesthetic agents.

Lidocaine

Lidocaine is the most commonly used local anesthetic. As an amide, it is hepatically metabolized and has a longer duration of action than ester anesthetics, which are locally metabolized by esterases. Lidocaine is available in 0.5, 1, 2, and 4 % concentrations with or without epinephrine. The lowest concentration is preferable in infants and young children secondary to the risk of systemic toxicity. It has a rapid onset of action (30–60 s) but a relatively short duration (30–120 min) (Benz 1992). Its duration of action is shortened without epinephrine since it is the most potent vasodilator of all local anesthetics. The maximum recommended dose of lidocaine with epinephrine is 7 mg/kg, which is equivalent to 50 ml of a 1 % lidocaine concentration for a 70-kg person (Tetzlaff 2000). Without epinephrine, the maximum recommended lidocaine dose should be halved.

Bupivacaine

Bupivacaine is also an amide local anesthetic. It is four times as potent as lidocaine and has a longer onset of action (5 min) as well as a longer duration of action (120–180 min) (Benz 1992). Therefore, it is commonly mixed with lidocaine in order to provide continuous analgesia during longer procedures as well as some postoperative analgesia. The maximal recommended dose of bupivacaine with epinephrine is 2.5–3 mg/kg (Tetzlaff 2000). This is equivalent to 35–40 ml of a 0.5 % bupivacaine concentration for a 70-kg person.

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Epinephrine

Local anesthetics cause vasodilation secondary to paralysis of the vascular smooth muscle. This can be counteracted by epinephrine. This limits absorption of the local anesthetic into the bloodstream, thereby preventing systemic side effects. Vasoconstriction also increases the local anesthetic duration of action by slowing its removal. Due to its vasoconstrictive effect, epinephrine should be used cautiously in the penis, digits (Krunic et al. 2004), and ears to avoid tissue necrosis.

Epinephrine should be used cautiously in young children and patients with cardiac conditions as it raises heart rate and blood pressure and can cause arrhythmias. The maximal recommended dose for cardiac patients is 0.2 mg in 40 ml of a 1:200,000 dilution (Brown and Rhodus 2005; New York Heart Association 1955). The optimal concentration to prolong the duration of local anesthesia is 1:200,000. Higher concentrations do not significantly enhance anesthetic duration and can increase the risk of side effects. It can be diluted to 1:400,000 by using a 50:50 mixture of lidocaine with a 1:200,000 concentration of epinephrine and bupivacaine without epinephrine. Of note, the epinephrine concentration can be unpredictable in the premixed form and is usually much lower than labeled. For a more reliable 1:100,000 dilution, one can add 5 ml of 8.4 % sodium bicarbonate to a 50-ml bottle of 2 % lidocaine and 0.55 ml of epinephrine 1:1,000 (John B. Holds, MD, personal communication).

EMLA

Topical anesthetic creams can increase patient tolerance of local anesthetic injections. EMLA cream is a mixture of 2.5 % lidocaine and 2.5 % proparacaine applied to intact skin with an overlying occlusive dressing to enhance absorption (Lidocaine and prilocaine 2005). For minor procedures, including venipuncture or anesthetic injection, EMLA should be applied 1 h ahead of time. For split thickness skin graft harvesting or laser treatment, it should be applied for 2 h. Presurgical planning with a prescription and careful instructions on the amount, site, and time of application is necessary for maximal efficacy. The upfront effort involved on behalf of the patient and the staff giving the instructions can outweigh the analgesic benefit of EMLA cream as compared to other quicker analgesic approaches. Although systemic side effects are rare, bloodstream levels are directly related to area and duration of application and body weight. Local but transient side effects include skin blanching, edema, and erythema. Periocular use is contraindicated since contact with the ocular surface causes severe irritation and requires copious irrigation.

Other Topical Anesthetics

A number of other topical skin anesthetics are available, including Ela-Max, Topicaine, and topical tetracaine gel. These topical agents all have limitations, as well as a maximum surface area that can be treated if toxicity is to be avoided.

The editors have had particular success with betacaine-LA ointment, which is compounded from lidocaine, prilocaine, and phenylephrine and is available from Custom Scripts Pharmacy in Tampa, Florida. This compounded ointment has the advantage of being applied without occlusion and providing superior anesthesia in 10–20 min.

Bicarbonate

To reduce the pain of local anesthetic injection, bicarbonate 8.4 % can be added to the mixture in a 1:4–1:10 ratio. By buffering the slightly acidic pH of the anesthetic (lidocaine pH is 6.4), pain is significantly reduced without affecting the onset or duration of action of the anesthetic (Davies 2003; Parham and Pasieka 1996).

Benzyl Alcohol

An alternative to bicarbonate for pain reduction of local anesthetic injection is saline with 0.9 % benzyl alcohol. It is a bacteriostatic agent with

local anesthetic properties (Yuen and Dolman 1999). The authors use a 1:1:1 mixture of 2 % lidocaine with 1:100,000 epinephrine, 0.75 % bupivacaine, and saline with 0.9 % benzyl alcohol for direct infiltration of local periocular and facial anesthesia.

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