Systemic Toxicity From Topically Applied Lidocaine in Conjunction With Fractional Photothermolysis

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Background: Topical anesthetics, unlike injectable anesthetics, can be applied painlessly and can provide sufficient pain control to maintain patient comfort throughout a variety of laser procedures. Although the use of topical lidocaine is considered relatively safe, instances of cardiotoxic and neurotoxic adverse events have been reported to occur.

Observations: A 52-year-old woman underwent fractional photothermolysis for management of severe hypopigmentation and scarring of several years' duration. Shortly after termination of treatment to her face and neck, which required prolonged exposure to a 30% lidocaine gel compound both before and during surgery, she developed clinical signs and symptoms consistent with systemic lidocaine toxicity. The results of laboratory studies confirmed serum lidocaine levels within the toxic range. We postulate that the combination of the high concentration of topical lidocaine required to achieve sufficient anesthesia, together with the laser-induced disruption in epidermal barrier function, may have been responsible for this phenomenon.

Conclusions: Application of a 30% topical lidocaine gel to a limited area in conjunction with fractional photothermolysis may generate serum lidocaine levels high enough to elicit systemic toxicity. Laser surgeons should be alert to this phenomenon, particularly in patients with underlying hepatic, endocrine, cardiac, or central nervous system/psychiatric dysfunction; in patients with a low body mass index; and in patients who are taking medications that may interfere with hepatic lidocaine metabolism.

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The central nervous and cardiovascular systems are particularly susceptible to the action of local anesthetics. The sequence of events related to the central nervous system after a progressive increase of local anesthetic agents is as follows: paresthesias, dizziness or light-headedness, drowsiness, excitation, abnormal behavior, fasciculations, and tremors. Ultimately, in severe toxic reactions, clonic muscular contractions and convulsions occur.1 The cardiovascular system is somewhat more resistant to the toxic effects of local anesthetics than the central nervous system. Cardiovascular toxicity usually manifests as tachycardia and hypertension. Ventricular arrhythmias and cardiac arrest are also known adverse effects. At high blood levels, most local anesthetics also act as direct myocardial depressants, which, coupled with their intrinsic vasodilator properties, may produce hypotension.2

A 52-year-old white woman presented to our clinic for management of severe hypopigmentation and scarring due to postsurgical infection and wound dehiscence that had occurred after she underwent a facelift by another physician several years earlier. She agreed to undergo fractional resurfacing. This new technology (Fraxel; Reliant Technologies, Palo Alto, Calif) relies on a 1550-nm diode-pumped erbium fiber laser delivered through an optically tracked microprocessor-controlled handpiece to produce an array of microscopic thermal zones (MTZs). Each of these zones is extremely thin (approximately 100 µm in diameter) and 400 to 700 µm deep, producing a column of thermal damage that results in collagen denaturation.3 The procedure is painful and requires application of a 30% lidocaine gel both for reducing discomfort and for allowing easy gliding of the treatment handpiece along the skin.

After a tracking dye was applied according to company specifications, 30% lidocaine gel was applied to the entire face and neck anterior to the sternocleidomastoid muscle. One hour after application, treatment was performed at the following settings: forehead, 11 mJ, 250 MTZ/cm², 8 passes; face and neck, 13 mJ, 250 MTZ/cm², 4 passes; followed by 6 mJ, 250 MTZ/cm², 2 passes. Within less than 5 minutes of treatment termination, the patient became visibly agitated...

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Topical anesthetics, unlike injectable anesthetics, can be applied painlessly and can provide sufficient pain control to maintain patient comfort throughout a variety of laser procedures. Although the use of topical lidocaine is considered relatively safe, instances of cardiotoxic and neurotoxic adverse events have been reported. In January 2005, a 22-year-old woman, in excellent health, experienced convulsions; and spot diameter, 6 mm) before application of 4% lidocaine cream decreases the time necessary to obtain cutaneous anesthesia from 60 minutes to 5 minutes. Percutaneous absorption follows a dose-response curve and increases with temperature.17 It is known that fractional photothermolysis creates countless zones of epidermal disruption, and tissue heating is a direct consequence of absorption of laser energy by water, the device's selective chromophore.1 These phenomena may help explain the symptoms that were observed in our patient, as well as the timing in the onset of symptoms immediately after treatment. Despite the findings presented herein, it should be noted that fractional resurfacing in conjunction with 30% lidocaine topical anesthesia has an excellent safety record. In fact, the procedure has been performed in our office almost 1000 times, and clinical symptoms of lidocaine toxicity have been observed in only 1 other instance, involving treatment of the entire back for acne scarring. In conclusion, application of a 30% topical lidocaine gel to a limited area in conjunction with fractional photothermolysis may generate serum lidocaine levels high enough to elicit systemic toxicity. Further studies are war-
ranted to explore the pharmacokinetics of this agent in this unique and expanding clinical setting. In the meantime, laser surgeons should be alert to this phenomenon, particularly in patients with underlying hepatic, endocrine, cardiac, or central nervous system/psychiatric dysfunction; in patients with a low body mass index; and in patients who are taking medications that may interfere with hepatic lidocaine metabolism.

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REFERENCES

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