Successful Treatment of the Erythema and Flushing of Rosacea Using a Topically Applied Selective \(\alpha_1\)-Adrenergic Receptor Agonist, Oxymetazoline

Stuart D. Shanler, MD; Andrew L. Ondo, MD; School of Medicine, University of New Mexico, Albuquerque (Dr Ondo).

Dr Shanler is in private practice in New York, New York.

The Cutting Edge: Challenges in Medical and Surgical Therapeutics

The erythematotelangiectatic (ETR) subtype of rosacea is characterized by frequent episodes of facial flushing and persistent centrofacial erythema and may be accompanied by telangiectasias, facial edema, burning, or stinging. The pathophysiologic cause of the erythema is uncertain, and there are currently no satisfactory treatments for this common form of rosacea.

**CASE 1**

A 55-year-old man presented with a long history of ETR rosacea manifesting with prolonged facial flushing provoked by multiple stimuli including heat, exercise, sun exposure, and the consumption of alcoholic beverages. He confided that he was particularly disturbed that, for many years, people frequently asked him: “Why is your face so red?” His condition had progressed over the last 15 years to include persistent facial erythema. In addition to his usual triggers, he had noted that during his workday in an air conditioned office the erythema worsened, usually peaking in early afternoon, sometimes with concurrent facial stinging or burning. He had previously been treated with several oral antibiotics, multiple topical therapies including metronidazole, and most recently azelaic acid gel, with no effect. He asked if there was anything that might help the erythema and symptoms.

**CASE 2**

A 70-year-old woman presented with a history of ETR rosacea, progressively worsening throughout her adult life. Although she had endured episodic flushing for decades, her erythema had become persistent in recent years. She had used numerous topical antibiotics for decades, including metronidazole, clindamycin phosphate, and combination sodium sulfacetamide, 10%, and precipitated sulfur, 5%, in an attempt to alleviate the erythema. She noted no improvement with the use of any of these agents and stated that she had continued using them “more out of hope” than because the medications had any effect. She had also used topical tretinoin with no improvement and had considered pulsed-dye laser therapy but had decided against it.

**SOLUTION**

An attempt to treat ETR rosacea using an over-the-counter drug known to possess vasoconstrictive properties was undertaken. A commercially available preparation of oxymetazoline hydrochloride, 0.05%, solution was applied once daily to the affected area of the face.

Patient 1 and her physician (1 of us) (A.L.O.) noted a decrease in facial erythema within 1 hour of drug application, and a dramatic improvement within 2 to 3 hours. This effect was sustained throughout the entire day. After a 7:30 AM application of the drug, the patient noted an improvement in the chronic “baseline” erythema, and experienced a marked reduction in his transient flares. His erythema continued to be controlled in the early afternoon, at his normal time of peak erythema, and he experienced no stinging or burning (Figure).
Patient 2 reported a similar improvement in her appearance and symptoms. Two weeks after initiating therapy, she was so pleased with the response that she sent her physician (1 of us) (A.L.O.) a letter of thanks indicating that the treatment was still effective and that she had discontinued use of topical metronidazole, her most current treatment. She returned 3 months after initiating therapy and continued to evidence marked improvement in the erythema and had experienced no episodic flares or flushing.

Both patients were counseled that this treatment was “off label” and that even though the medication was over the counter, adverse effects could occur and could include the listed adverse effects of underlying heart disease, hypertension, thyroid disease, diabetes mellitus, and urinary retention. Both patients elected to continue treatment on their own. Patient 1 stated that “This is the first time my face has been normal in decades.” Six weeks after initiating once-daily application, patient 1 demonstrated continued control of the erythema and had complete relief of his facial stinging and burning. Neither patient experienced any adverse effects, has evidenced any rebound flares in erythema or other symptoms, or has demonstrated any tachyphylaxis to the current regimen. At the last follow-up examination, patient 1 had continued treatment for 8 months and patient 2 for 17 months, with sustained effects. Both patients had discontinued all other therapies directed toward their rosacea other than sunscreen use.

Figure. Baseline photograph of patient 1 immediately prior to application of oxymetazoline, 0.05%, solution (A) and 3 hours after topical application (B), demonstrating marked improvement in macular erythema and fine telangiectasias.

Rosacea is a common, chronic cutaneous disorder, the clinical manifestations and subtypes of which have been very well described and recently reviewed.1-3 Erythematotelangiectatic rosacea is the subtype of rosacea most characterized by its frequent episodes of transient facial erythema (flushing) and nontransient, or persistent, erythema. It may be accompanied by facial edema, burning, or stinging.4 While rosacea remains a disorder of uncertain etiology and pathogenesis, the abnormal flushing and persistent erythema have usually been theorized to arise from a dysregulation in the cutaneous vasomotor response, which, whether triggered by neurogenic, hormonal, thermal, topical, or other stimuli, has as its end result an abnormal and persistent dilation of facial blood vessels.1,2,4-7

The regulation of the cutaneous circulation is of paramount importance and is extremely complex. It is mediated by the sympathetic nervous system both locally, through the release of catecholamines from the sympathetic nerve terminals, and systemically, through their release into the general circulation by the adrenal medulla. In recent years, and with newer molecular genetic techniques, the simple model of 2 adrenergic receptors (adrenoceptors) that mediate the vascular response to catecholamines4 has been replaced. The concept of “generic” α-adrenergic receptors, responsible mostly for “excitatory” functions such as vasoconstriction and uterine and urethral contraction, and “generic” β-adrenergic receptors, responsible mostly for “inhibitory” functions such as vasodilatation, bronchodilation, and uterine and urethral relaxation (though notably inotropic for the heart) has been further refined and specific receptor subtypes, localizations, and functions have been elucidated. The current model is that of a complex family of structurally related receptors consisting of at least 6 α-receptor subtypes (α1A [α1A1], α1B, α1D, α2A [α2A2], α2B, and α2C) and at least 3 β-receptor subtypes (β1, β2, and β3),9-13 with additional conformational variants such as α1H and β1, bringing the total number of functional adrenoceptor conformations to at least 11.

These adrenergic receptors are all members of the G-protein–coupled receptor superfamily of proteins and modulate their effects through a classic 7-transmembrane protein second-messenger system. Their final local and systemic effects, however, are myriad, as noted previously, including vasoactive effects ranging from vasoconstriction to vasodilatation, and occur through a wide variety of intracellular mechanisms12 that are governed by local receptor subtype concentration, relative receptor subtype distribution throughout the body, ligand-binding characteristics, and other factors (eg, local temperature and hypoxia), the full discussion of which is beyond the scope of this article.9-13 Elegant in vitro, in vivo, and ex vivo studies in a variety of vascular tissues and species reveal that the contraction of peripheral vascular smooth muscle is primarily mediated by α1A– and α1D-receptor subtypes, although it varies in different vas-
cicular regions.10,11,15 Studies of α2-receptor suggest that αα2D and αα2E effects are also of importance, particularly on the arterial side, and that the αα2D and αα1C effects are of importance on the venular side, although variations based on the experimental model used are well reported.10-13,15

The actual physiologic and clinical responses to stimulating or inhibiting these receptors selectively is, however, difficult to predict.

Oxymetazoline is a synthetic, direct-acting, imidazoline-type sympathomimetic agonist that is highly selective for the αα1-receptor and is a partially selective αα2-receptor agonist as well. It is a potent vasoconstrictor. Locally applied α2-adrenoceptor agonists such as phentolamine hydrochloride, naphazoline hydrochloride, tetrahydrozoline hydrochloride, oxymetazoline hydrochloride, and xylometazoline hydrochloride are well known for their ability to clinically "get the red out" and have been used as vasoconstrictive agents in over-the-counter preparations for decades. These drugs have been used as decongestants on nasal and ocular mucous membranes for the treatment of conditions such as allergic rhinitis and conjunctivitis and decrease erythema and edema of the mucous membranes with safety and excellent efficacy. Selective α2-adrenoceptor agonists such as brimonidine tartrate and apraclonidine hydrochloride have similarly been applied to the ocular mucosa to take advantage of their vasoconstrictive (and other) actions to treat ocular hypertension and open-angle glaucoma, also with great efficacy. However, drugs of these classes have never been used for topical application to the skin.

Although it was initially believed that their effects were modulated purely through their vasoconstrictive properties, it has been demonstrated in recent years that several of the α-adrenergic receptor vasoconstrictors also exhibit significant anti-inflammatory properties. In upper respiratory tract infections, oxymetazoline and xylometazoline have been shown to inhibit neutrophilic phagocytosis and oxidative burst, resulting in a decrease in microbial killing, decreased generation of proinflammatory cytokines, and decreased inflammation.16,17 Oxymetazoline has also recently been shown to have significant effects on the arachidonic acid cascade, strongly inhibiting 5-lipoxygenase, and decreased inflammation.16,17 Oxymetazoline has also been demonstrated to inhibit neutrophilic phagocytosis and oxidative burst by components of decongestive nose drops.15 A potential clinical role for oxymetazoline, or other agents of this class, as inhibiting or inhibiting these receptors selectively is, how-

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Correspondence: Stuart D. Shanler, MD, 100 Winston Dr, Apt 17E North, Cliffside Park, NJ 07010 (sdsmd@aspectpharma.com).

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References