An Observational Study to Determine Whether Routinely Sending Patients Home With a 24-Hour Supply of Topical Tetracaine From the Emergency Department for Simple Corneal Abrasion Pain Is Potentially Safe

Neil Waldman, MD*; Ben Winrow, MBCHB; Ian Densie, BSR; Andrew Gray, BA, BCom; Scott McMaster, DO; George Giddings, MBCH; John Meanley, MBCHB

*Corresponding Author. E-mail: Neil.Waldman@southerndhb.govt.nz.

Study objective: To determine if the number of emergency department (ED) rechecks, persistent fluorescein uptake, ophthalmology referrals, or complications would be affected by the prescription of topical tetracaine for pain relief from simple corneal abrasions (SCAs).

Methods: This retrospective cohort study was conducted in an ED where policy change allowed physicians to use topical tetracaine hydrochloride 1% eye drops for 24 hours for pain treatment for patients with corneal abrasions. Outcomes were compared between patients who did or did not received tetracaine (adjusting for the propensity for treatment).

Results: Of 1,576 initial ED presentations, 532 were SCAs, with 1,044 deemed nonsimple corneal abrasions (NSCAs). Tetracaine was dispensed at the initial visit for 303 SCA presentations (57%) and inappropriately for 141 NSCA presentations (14%). There were no serious complications or uncommon adverse events attributed to tetracaine for all SCAs and NSCAs combined (0/459; upper 95% confidence interval [CI] 0.80%). The relative risks (RRs) of ED recheck and fluorescein staining were increased overall among patients who received tetracaine (RR 1.67, 95% CI 1.25 to 2.23; and RR 1.65, 95% CI 1.07 to 2.53 for recheck and staining, respectively). However, the relative risks for only SCAs receiving tetracaine was 1.16 (95% CI 0.69 to 1.93) and 0.77 (95% CI 0.37 to 1.62), respectively. Referrals to ophthalmology were significantly decreased for all patients (SCAs and NSCAs) dispensed tetracaine (relative risk 0.33; 95% CI 0.19 to 0.59). The number of complications was too small to permit modeling.

Conclusion: There was no evidence that up to 24-hour topical tetracaine for the treatment of pain caused by SCA was unsafe; however, CIs were wide and some increased risks were observed for NSCAs. [Ann Emerg Med. 2017;■:1-12.]

Please see page XX for the Editor's Capsule Summary of this article.

0196-0644/$-see front matter

http://dx.doi.org/10.1016/j.annemergmed.2017.02.016

SEE EDITORIAL, P. XXX.

INTRODUCTION

Background

Pain from corneal abrasions caused by foreign bodies or trauma is a common complaint in the emergency department (ED). Traditional management has been to administer topical anesthetic drops such as tetracaine and remove the foreign body if it is still present. Patients can then be sent home with oral analgesia or topical nonsteroidal anti-inflammatory drops, as well as topical antibiotics.[1-3]

Tetracaine, also known as amethocaine, is an ester-type anesthetic. Undiluted 1% tetracaine has a fast onset (10 to 20 seconds) and a short period of action (10 to 20 minutes) but has been reported to last up to 1 hour.[1,4] Although effective in reducing pain, its continued use by the patient has been discouraged because of concerns over safety and is prohibited according to traditional teaching.[5,6] Case reports of topical anesthetic abuse and misuse,[7-32] coupled with animal studies,[33-39] suggest that the use of topical tetracaine could lead to uncommon adverse events. Correction for these uncommon adverse events may include hospitalization, oral corticosteroids, contact lens bandages, and surgical procedures such as conjunctival flap, corneal transplantation, and penetrating keratoplasty.[21,30]

Editor's Capsule Summary

What is already known on this topic

Short-course topical anesthetic use for corneal abrasion pain is discouraged because of potential corneal toxicity.

What question this study addressed

Is limited (24-hour) treatment of simple corneal abrasion pain with topical tetracaine safe?

What this study adds to our knowledge

This single-center observational study of 1,980 patients with corneal abrasions found no serious complications among 459 instances of tetracaine use.

How this is relevant to clinical practice

Limited use of topic tetracaine for pain control of simple corneal abrasion may be acceptable, but large prospective studies are required to confirm safety.

In contrast, the literature defending the controlled use of a limited supply of topical anesthetics for simple corneal abrasions (SCAs) is increasing. Four studies have looked at the use of topical anesthetics after photorefractive keratectomy surgery.[40-43] Applied to clean surgical wounds, they were shown to effectively treat pain and not delay wound healing. Subsequently, 3 ED studies[44-46] looked at the treatment of pain caused by SCA. The results of the first 2 studies[44,45] showed no serious complications and a reduction of pain. In 2014, a larger randomized controlled trial also supported the safety of topical tetracaine.[46]

Two publications subsequently reviewed different combinations of these ED studies. Swaminathan et al[47] concluded that topical anesthetics are a safe and effective means of pain control in this patient population. However, Puls et al[48] concluded that because of a sparsity of data, the safety and effectiveness of this treatment is currently not supported by evidence. The most recent suggestion that thoughts on the topic are changing came in the 2015 edition of *Emergency Medicine Secrets*, stating that "…consensus is evolving regarding short-course therapy for uncomplicated corneal abrasions."[5]

Importance

Although highly effective in reducing pain, continued use of topical anesthetics has long been discouraged. Previous studies have suggested possible safety for short-term use; however, the studies have been small and there is a paucity of data. Larger and well-designed studies are needed to confirm or disprove these positions and allow evidence-based recommendations to be made. The potential clinical influence of these results could lead to better pain control for this common ED complaint at minimal cost and with a low risk of adverse outcomes.

Goals of This Investigation

We determined whether the routine use of a limited 24-hour supply of topical tetracaine for SCAs in an ED would be safe by comparing data of patients with corneal abrasions who did and did not received tetracaine. Although the focus is on SCAs, understanding the potential effects on nonsimple corneal abrasions (NSCAs) is also important because inappropriate prescription is an inherent risk.

The primary hypothesis was that numbers of ED rechecks, persistent fluorescein uptake, ophthalmology clinic referrals, and complications would not differ for patients receiving topical tetracaine for short-term pain relief, in particular for those with SCAs.

MATERIALS AND METHODS

Study Design and Setting

This retrospective cohort study took place at the ED of Southland Hospital, Invercargill, New Zealand. The hospital is a regional referral center servicing a population of approximately 93,300 over an area of 34,347 km^2. Emergency physicians at Southland Hospital gradually began to adopt the routine use of topical tetracaine for SCA in March 2014. The ED experiences an estimated 37,000 presentations a year and is the only hospital and ophthalmology clinic in the region, making it an ideal location for data collection and follow-up. In Southland, patients with corneal abrasions are treated in the ED and it is standard practice to recommend they return to the ED in 48 hours if they are not improving, sooner if symptoms worsen or at the discretion of the treating physician. Fluorescein staining at ED recheck is generally conducted to determine healing. Fluorescein staining was performed if symptoms were persistent; however, it was not conducted if there was a persistent foreign body or there were repeated attempts at foreign body removal in the ED on that visit because staining would be expected to show uptake. Follow-up in the ophthalmology clinic is reserved for patients with corneal abrasions that are not resolving normally or are complicated, or for other corneal diagnosis. Ophthalmology clinic referrals were made at the ED recheck if there were concerning features. There was no standard time frame for this referral, which was made on a case-by-case basis.

ED patients are treated by a mixture of junior physicians (interns), emergency physicians in training (residents),