Rescue Sedation With Intranasal Dexmedetomidine for Pediatric Ophthalmic Examination After Chloral Hydrate Failure: A Randomized, Controlled Trial

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ABSTRACT

Purpose: It is a challenge to rescue ophthalmology examinations performed in children in the sedation room after initial chloral hydrate failure. Intranasal dexmedetomidine can be used in rescue sedation in children undergoing computed tomography. The present study aimed to assess the efficacy and tolerability of intranasal dexmedetomidine use in children undergoing ophthalmic examination after chloral hydrate failure.

Methods: Sixty uncooperative pediatric patients with cataract (aged 5–36 months; weight, 7–15 kg) presented for follow-up ophthalmic examination. Patients who experienced chloral hydrate failure were randomized to 1 of 2 groups to receive intranasal dexmedetomidine 1 or 2 μg/kg for rescue sedation. Each group contained 30 patients. The primary outcome was the rate of a successful ophthalmic examination. Secondary outcomes included sedation onset time, recovery time, duration of examination, discharge time, and adverse events, including percentage of heart rate reduction, respiratory depression, vomiting, and postsedative agitation.

Findings: A successful ophthalmic examination was achieved in 93.3% (28/30) of patients in the 2-μg/kg dose group and in 66.7% (20/30) of patients in the 1-μg/kg dose group ($P = 0.021$). The onset time, recovery time, and discharge time did not significantly differ between the 2 groups. None of the patients required clinical intervention due to heart rate reduction, and none of the patients in either group experienced vomiting, respiratory depression, or agitation after the administration of dexmedetomidine.

Implications: In children undergoing ophthalmic examination, intranasal dexmedetomidine can be administered in the sedation room for rescue sedation after chloral hydrate failure, with the 2-μg/kg dose being more efficacious than the 1-μg/kg dose, as measured by success rate. ClinicalTrials.gov identifier: NCT02077712. (*Clin Ther*. 2016;38:1522–1529)

Key words: chloral hydrate, dexmedetomidine, ophthalmic, pediatric, sedation.

INTRODUCTION

Detailed examinations and diagnostic procedures are necessary for ophthalmologists to appropriately treat pediatric patients with eye diseases.[1] Therein, it becomes very important to sedate uncooperative children.[2] Chloral hydrate is one of the most commonly used agents for mild to moderate sedation in children who cannot tolerate a painless procedure.[3] Chloral hydrate administered by trained nurses has been used for many years for sedation in pediatric ophthalmic examinations, without an accompanying significant risk for respiratory depression.[4] Furthermore, a recent large-scale study reported that chloral hydrate was well-tolerated in ophthalmic examinations, with a 92.8% success rate at a dose of 80 mg/kg.[5]

Maintaining a fixed eye position, with a vertical alignment of the head, on the scanner during

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ophthalmic examinations is required for obtaining accurate data. However, this special position, which is different from that required for other examinations, may require moderate to deep sedation in children. It should be noted that many children cannot complete the examination even with a maximal dose of chloral hydrate, mostly due to a high prevalence of vomiting and diarrhea and the special examination position required.[6–8] General anesthetic agents such as propofol, fentanyl, midazolam, and ketamine are often ultimately used for rescue sedation in the surgical suite,[9,10] but their use may result in a higher cost than when administered in the sedation room.[11] Unfortunately, it remains a challenge in the sedation room to complete the examinations in children initially sedated using chloral hydrate because of the potential synergistic respiratory depression and airway obstruction with the administration of an additional sedative/anesthetic agent.[12]

Dexmedetomidine is a highly selective α_2-adrenergic receptor agonist with sedative and mild analgesic effects. Evidence has suggested that IV dexmedetomidine provides an advantage in pediatric sedation during noninvasive diagnostic procedures, such as nuclear medicine imaging.[13] Although the bioavailability of intranasal dexmedetomidine may be reduced, the advantage of administering intranasal dexmedetomidine over IV dexmedetomidine is that IV cannulation is not required. Furthermore, intranasal dexmedetomidine could be used for rescue sedation after chloral hydrate failure by providing moderate to deep sedation in children scheduled to undergo computed tomography.[14] The sedation produced by dexmedetomidine has been shown to be similar to natural sleep, which suggests that dexmedetomidine minimally influences respiratory depression.[15] Thus, we hypothesized that intranasal dexmedetomidine administered in the sedation room can provide effective rescue sedation after initial chloral hydrate failure during ophthalmic examination, without increasing adverse events. This hypothesis was tested by assessing the efficacy and tolerability of dexmedetomidine 1 or 2 μg/kg in children who failed chloral hydrate sedation.

PATIENTS AND METHODS

The protocol of this single-center, prospective, randomized, controlled trial (ClinicalTrials.gov identifier: NCT02077712) was approved by the institutional review board at the Zhongshan Ophthalmic Center (Guangzhou, People's Republic of China). Written informed consent was obtained from at least one parent of each participating child, and the tenets of the Declaration of Helsinki were followed throughout the study.

Patients

Patients were recruited from the Zhongshan Ophthalmic Center between February 2014 and January 2015 as members of the Childhood Cataract Program of the Chinese Ministry of Health.[16] Sixty children of American Society of Anesthesiologists physical status 1 or 2 and aged between 5 and 36 months were enrolled. Children were enrolled 2 hours after failing an initial 80-mg/kg oral or rectal dose of choral hydrate for sedation for cataract examination. *Chloral hydrate failure* was defined as no signs of sedation, and/or resistance to ophthalmic examinations requiring a fixed eye position in vertical alignment of the head 45 minutes after the administration of chloral hydrate.

Based on the Childhood Cataract Program of the Chinese Ministry of Health guideline for study design, patients with glaucoma, ocular trauma, corneal disorders, persistent hyperplastic primary vitreous, rubella, Lowe syndrome, capsular fibrosis, or surgical complications and those who could not complete the follow-up were excluded. Specifically, in this randomized, controlled trial, children with gastroesophageal reflux; nausea and vomiting; apnea in the preceding 3 months; recent pneumonia, exacerbation of asthma, bronchitis, and/or upper respiratory tract infection; severe arrhythmia, heart failure, or cardiac structural abnormalities; facial abnormalities; severe neurologic disease; moyamoya disease; allergy to dexmedetomidine; receiving digoxin and/or β-blockers; and/or who weighed <2 kg were also excluded.

Randomization Grouping

Before the trial, randomized treatment allocation with no further stratification was generated by an independent person using a computerized random-number generator with a 1:1 allocation. The patients were randomly assigned to 1 of 2 dose groups that received either 1 or 2 μg/kg of intranasal dexmedetomidine.

Protocols of Sedation for Pediatric Ophthalmic Examination

Undiluted, preservative-free dexmedetomidine (provided by Ai Bei Ning, Jiang Su Heng Rui Medicine