Peertechz

Journal of Cardiovascular Medicine and Cardiology
submitpaper@peertechz.com
MEDICAL GROUP
JOURNAL OF Cardiovascular Medicine and Cardiology OPEN ACCESS JOURNAL
ISSN: 2455-2976 DOI: https://dx.doi.org/10.17352/jcmc

Short Communication

Cardiovascular Effects of Treatment with Atropine 0.01% Eyedrops to prevent the Progression of Childhood Myopia

Lluís Cavero-Roig[1], Lluís Cavero-Negre[2], Anna Mones[3], Àngels Ferrero Rosanas[4], Paula S Ventura[5] and Jose M Siurana[6]

[1]Paediatric Ophthalmology Department, Institut Català de Retina, Spain
[2]Universitat Internacional de Catalunya, Spain
[3]Paediatric Ophthalmology Department, Hospital HM Nens, Spain
[4]Optometry Department, Hospital HM Nens, Spain
[5]Statistical Department, Hospital HM Nens, Spain
[6]Paediatric Cardiology Department, Hospital HM Nens. HM Hospitales, Spain

Received: 06 September, 2024
Accepted: 24 September, 2024
Published: 25 September, 2024

***Corresponding author:** Jose Manuel Siurana, Cardiology Department, Paediatric Cardiology Department, Hospital HM Nens, HM Hospitales, calle Consell de Cent 437, 08009 Barcelona, Spain,
E-mail: jmsiurana@hotmail.com

Keywords: Atropine; Cardiovascular effect; Children; Myopia progression

https://www.organscigroup.com

Check for updates

Abstract

The effectiveness of atropine eyedrops in preventing myopia progression in children has been confirmed, but cardiovascular effects have never been analysed. The objective of this study was to assess cardiovascular changes after treatment with atropine 0.01% eyedrops in 60 paediatric patients who were treated with atropine eyedrops due to myopic progression. Patients were analysed before treatment and 3 months after starting 1 drop daily. The parameters assessed were cardiovascular constants and electrocardiographic data.

The average age was 10.2 years, with a higher women percentage. The average follow-up period was 3.5 months. No patients presented pathological electrocardiographic findings and one patient reported symptoms: palpitations. A statistically significant decrease in heart rate (79 *vs.* 75 bpm) was reported, but without clinical significance. No changes in blood pressure were observed.

In conclusion, chronic therapy with low doses of atropine as a treatment for myopia progression does not result in pathological heart changes.

Introduction

Atropine eyedrops have been an increasingly used treatment for myopia progression in children since 2016 when the effectiveness and safety of atropine eyedrops were confirmed [1,2]. The first published studies were with atropine 1%, but later new studies showed similar efficacy and fewer side effects with lower concentrations, 0.5% and 0.01% [3-5]. The reported adverse effects of atropine 0.01% eyedrops have been erythema and ocular pruritus, although with a < 1% rate [4-6]. Pérez-Flores, et al. [7] described a case of transient tachycardia in a myopic patient treated with topical atropine 0.01 % eyedrops (1/105 patients) that ceased with treatment suspension.

Although this drug has documented systemic effects in the injected form, they have never been analysed in the low-dose atropine's topical form. Atropine's action consists of a parasympathetic inhibition and the systemic adverse effects include tachycardia, atrial arrhythmias, and hypertension.

The objective of this study is to assess the cardiovascular changes after treatment with atropine 0.01% eyedrops to reduce myopia progression in children.

Patients and methods

Sixty patients were prospectively recruited for treatment with atropine 0.01% eyedrops due to myopic progression of

Citation: Cavero-Roig L, Cavero-Negre L, Mones A, Rosanas ÀF, Ventura PS, Siurana JM. Cardiovascular Effects of Treatment with Atropine 0.01% Eyedrops to prevent the Progression of Childhood Myopia. J Cardiovasc Med Cardiol. 2024;11(3):024-026. Available from: https://dx.doi.org/10.17352/2455-2976.000206

0.50 diopter or more per year. No patient was excluded because of cardiac pathology, but six rejected it. Therefore, 54 patients were analysed before atropine treatment and 3 months after starting 1 daily drop in each eye of atropine eyedrops, occluding the tear duct for 1 minute to minimize systemic absorption. Parameters assessed were: somatometric data (weight, height, and body mass index), constants (heart rate and blood pressure), electrocardiographic data (P wave axis, PR segment, and arrhythmic disturbances), and ultrasound data (end-diastolic left ventricle diameter). To reduce the Heart Rate (HR) variability the arithmetic mean was obtained from an electrocardiogram and Automatic Blood Pressure and Heart Rate Monitor measurements, in the supine position after resting for 5 minutes. Cardiac ultrasound and electrocardiogram tests were performed by the same operator. No patient was excluded due to personal or family history of cardiac pathology.

Data were tested for normality using the Kolmogorov-Smirnov test. Normally distributed data were summarised as means and 95% CIs and analysed using the Student t-test. Skewed data were expressed as medians and 25% - 75% IQRs, and evaluated using a Wilcoxon nonparametric signed rank test. $p < 0.05$ was accepted. The study was approved by the hospital's scientific committee and patients agreed to participate through informed consent.

Results

The average age was 10.2 years (range: 5 to 14), with a higher female percentage (68.5% *vs.* 31.5%). No patients presented structural or arrhythmic pathological findings.

In two patients, a small patent foramen ovale was diagnosed but it did not contraindicate atropine's treatment.

The average follow-up period was 3.5 months (range: 1 to 12). All patients were asymptomatic, except a 12-year-old girl who reported palpitations from the beginning of treatment, which were diagnosed as sinus tachycardias due to anxiety. Atrial premature beats were reported in an 8-year-old girl, but an extended analysis with an ambulatory 24-hour electrocardiogram resulted in a percentage < 1%. Statistical data are summarized in Table 1.

Discussion

Atropine is a liposoluble substance, absorbed through the conjunctival sac and nasal mucosa. Half of the atropine's dose goes directly into the systemic circulation, through the conjunctival sac and nasal mucosa [8]. Atropine's cardiovascular effect consists of blocking acetylcholine at M2 muscarinic receptors. The parasympathetic inhibition in nodal tissue results in an HR increase.

In the preventive treatment with atropine 0.01% eyedrops, the total dose administered was 0.01 mg. HR variation or significant arrhythmias with low doses of atropine have not been found in current research [9,10].

Our study shows a statistically significant decrease in HR (Figure 1) but without clinical relevance. Mean HR values in pre-atropine (79 bpm) and post-atropine (75 bpm) determinations are framed in 25-75 percentiles of normal ranges of HR for the 8-12 year-old population [11,12], therefore these HR values could be observed in most rest measurements in normal pediatric population.

Table 1: Comparative results before and after three months of treatment with atropine 0.01% eyedrops.

	Pre-atropine	Post-atropine	*p* - value
Weight (kg)	40.6 (37.1 to 44.1)	41.5 (38.1 to 45.0)	< 0.01
Body Mass Index	18.3 (17.4 to 19.1)	18.3 (17.5 to 19.2)	0.56
Heart rate (bpm)	79 (75 to 82)	75 (71 to 79)	0.01
Systolic Blood Pressure (mmHg)	106 (104 to 109)	106 (103 to 108)	0.61
Diastolic Blood Pressure (mmHg)	63 (61 to 65)	61 (59 to 63)	0.29
P Axis (degrees)	45 (30 to 60)	45 (30 to 60)	0.13
PR Segment (msec)	125 (120 to 129)	124 (120 to 128)	0.32
Z score end-diastolic LV diameter	-0.7 (-0.9 to -0.4)	-0.6 (-0.8 to -0.4)	0.08

Values are expressed in mean and 95% CIs or median and 25-75% IQR (center 50% of data); *p* - value calculated by Wilcoxon nonparametric signed rank test; bpm: beats per minute.

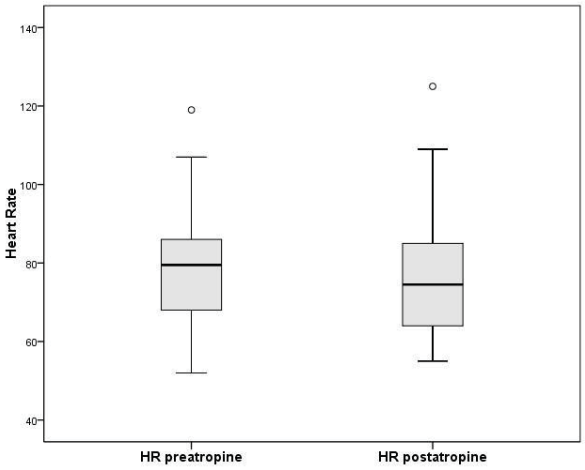

Figure 1: Heart rate box and whiskers plots at the beginning and after three months of treatment with atropine eyedrops, which show a median and 25-75% interquartile range. There was a significant difference in the Student t - test. HR: Heart rate.

There were no structural changes in the left ventricle or in conduction velocity, and it is unlikely that atrial premature beats documented in a patient were the consequence of atropine treatment, because of their low percentage, common in normal population. Nevertheless, atropine eyedrops were discontinued. During follow-up, the patient continued to present a low percentage of atrial premature beats in the follow-up.

No significant blood pressure variation was observed. Atropine has a minimum effect on blood vessels due to the poor number of muscarinic receptors.

This study has certain limitations. The lack of a control group and small sample size limit the statistical power strength and prevent reaching firm conclusions, but we want to highlight that no clinically relevant changes have been shown.

Citation: Cavero-Roig L, Cavero-Negre L, Mones A, Rosanas ÀF, Ventura PS, Siurana JM. Cardiovascular Effects of Treatment with Atropine 0.01% Eyedrops to prevent the Progression of Childhood Myopia. J Cardiovasc Med Cardiol. 2024;11(3):024-026. Available from: https://dx.doi.org/10.17352/2455-2976.000206

Conclusion

In conclusion, chronic therapy with a low dose of atropine, as a treatment for the prevention of childhood myopia progression, does not appear to result in pathological heart changes.

Declarations

Ethics approval: This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Nens Hospital's scientific committee.

Consent to participate: Written informed consent was obtained from the parents.

Consent for publication: Patients signed informed consent regarding publishing their data.

References

1. Huang J, Wen D, Wang Q, McAlinden C, Flitcroft I, Chen H, et al. Efficacy comparison of 16 interventions for myopia control in children: a network meta-analysis. Ophthalmology. 2016;123(4):697-708. Available from: https://doi.org/10.1016/j.ophtha.2015.11.010

2. Moriche-Carretero M, Revilla-Amores R, Gutiérrez-Blanco A, Moreno-Morillo FJ, Martinez-Perez C, Sánchez-Tena MÁ, et al. Five-year results of atropine 0.01% efficacy in the myopia control in a European population. Br J Ophthalmol. 2024;108(5):715-719. Available from: https://doi.org/10.1136/bjo-2022-322808

3. Chia A, Chua WH, Cheung YB, Wong WL, Lingham A, Fong A, et al. Atropine for the treatment of childhood myopia: safety and efficacy of 0.5%, 0.1%, and 0.01% doses (Atropine for the Treatment of Myopia 2). Ophthalmology. 2012;119(2):347-354. Available from: https://doi.org/10.1016/j.ophtha.2011.07.031

4. Gong Q, Janowski M, Luo M, Wei H, Chen B, Yang G, et al. Efficacy and adverse effects of atropine in childhood myopia: a meta-analysis. JAMA Ophthalmol. 2017;135(6):624-630. Available from: https://doi.org/10.1001/jamaophthalmol.2017.1091

5. Vidhya C, Murali K, Sowmya R. Safety and efficacy of reconstituted atropine 0.01% eye drops for Indian children with myopic progression. Asian J Ophthalmol. 2020;17(2):209-215. Available from: https://doi.org/10.35119/asjoo.v17i2.572

6. Gong Q, Liu L. Therapeutic effect of atropine 1% in children with low myopia. JAAPOS. 2016;20(4):379. Available from: https://www.jaapos.org/article/S1091-8531(16)00085-9/fulltext

7. Pérez-Flores I, Macías-Murelaga B, Multicenter Group of Atropine Treatment for Myopia Control (GTAM), Barrio-Barrio J. Age-related results over 2 years of the multicenter Spanish study of atropine 0.01% in childhood myopia progression. Sci Rep. 2023;13(1):16310. Available from: https://doi.org/10.1038/s41598-023-43569-x

8. Kaila T, Korte JM, Saari KM. Systemic bioavailability of ocularly applied 1% atropine eyedrops. Acta Ophthalmol Scand. 1999;77(2):193-196. Available from: https://doi.org/10.1034/j.1600-0420.1999.770215.x

9. Jones P, Peters MJ, Pinto da Costa N, Kurth T, Alberti C, Kessous K, et al. Atropine for critical care intubation in a cohort of 264 children and reduced mortality unrelated to effects on bradycardia. PLoS One. 2013;8(2). Available from: https://doi.org/10.1371/journal.pone.0057478

10. Eisa L, Passi Y, Lerman J, Raczka M, Heard C. Do small doses of atropine (<0.1 mg) cause bradycardia in young children? Arch Dis Child. 2015;100(7):684-688. Available from: https://doi.org/10.1136/archdischild-2014-307868

11. Fleming S, Thompson M, Stevens R, Heneghan C, Plüddemann A, Maconochie I, et al. Normal ranges of heart rate and respiratory rate in children from birth to 18 years of age: a systematic review of observational studies. Lancet. 2011;377(9770):1011-1018. Available from: https://doi.org/10.1016/s0140-6736(10)62226-x

12. O'Leary F, Hayen A, Lockie F, Peat J. Defining normal ranges and centiles for heart and respiratory rates in infants and children: a cross-sectional study of patients attending an Australian tertiary hospital paediatric emergency department. Arch Dis Child. 2015;100(8):733-737. Available from: https://doi.org/10.1136/archdischild-2014-307401

Citation: Cavero-Roig L, Cavero-Negre L, Mones A, Rosanas ÀF, Ventura PS, Siurana JM. Cardiovascular Effects of Treatment with Atropine 0.01% Eyedrops to prevent the Progression of Childhood Myopia. J Cardiovasc Med Cardiol. 2024;11(3):024-026. Available from: https://dx.doi.org/10.17352/2455-2976.000206